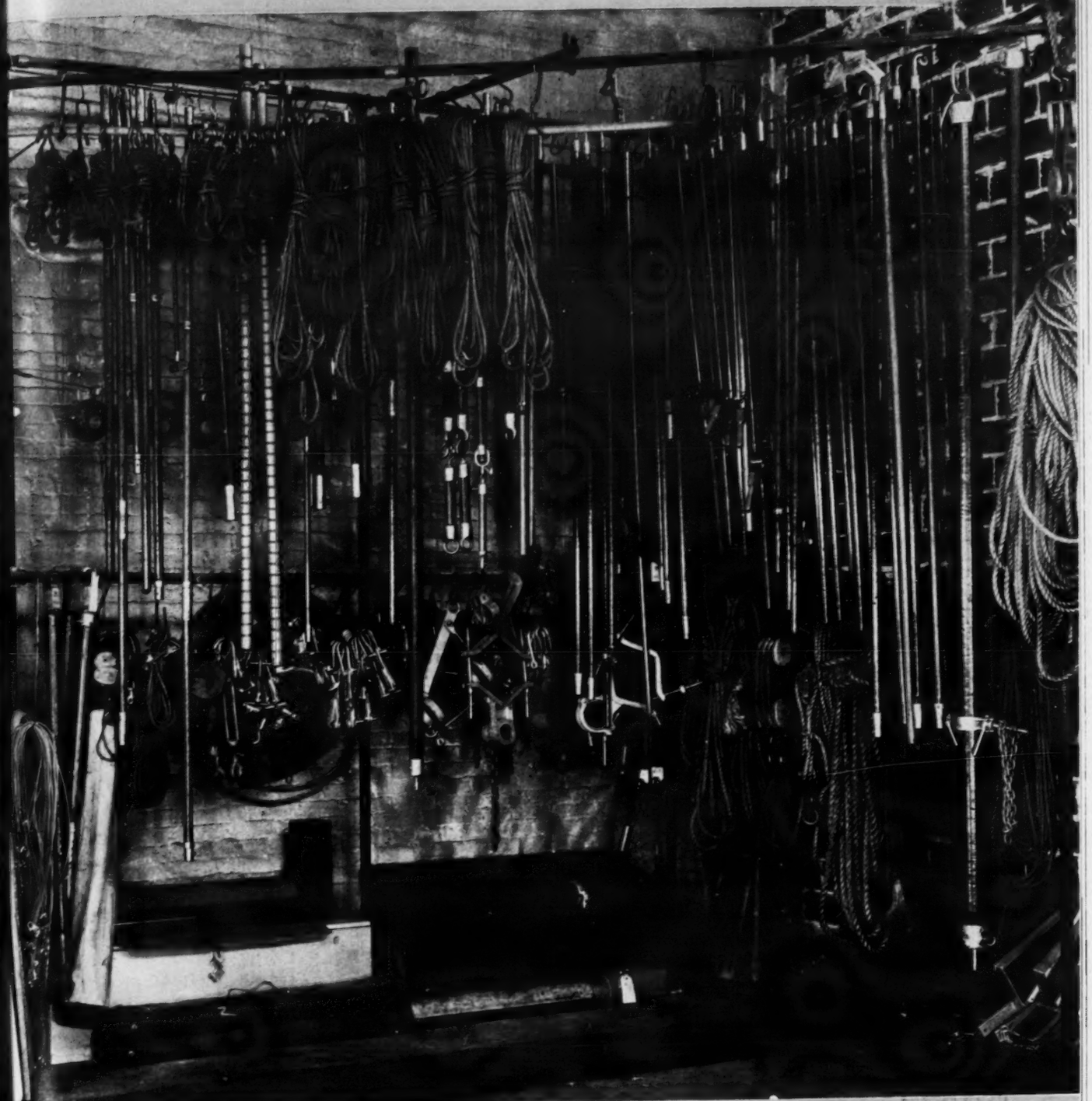
UNIVERSITY OF CALIFORNIA
MAY 24 1944

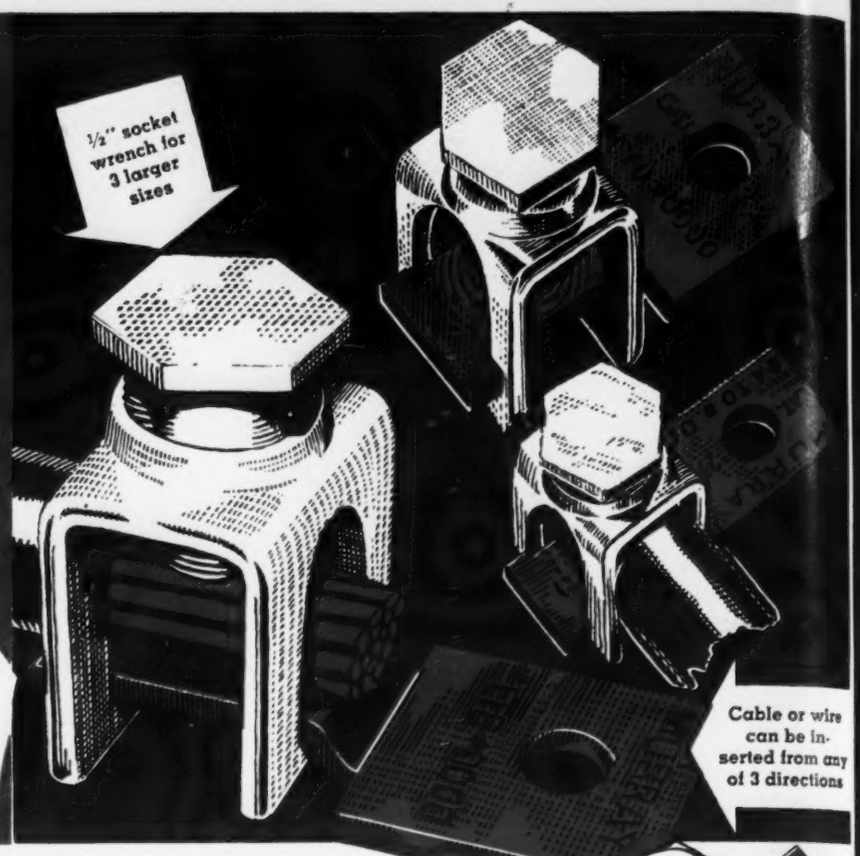
Electrical World

MAY 13, 1944

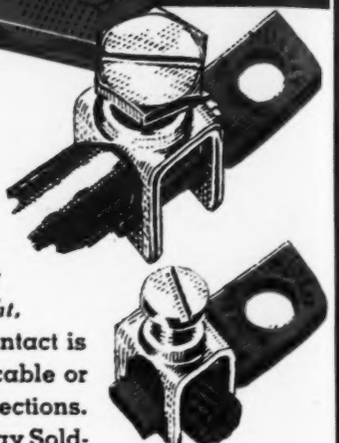


LIVE-LINE TOOL MAINTENANCE REQUIRES PROPER STORAGE

SOLDERLESS CONNECTORS THAT HOLD LIKE A VISE!


½" socket wrench for 3 larger sizes
Enormous pressure makes electrical contact absolute
Cable or wire can be inserted from any of 3 directions

FROM YOUR JOBBER — HE HAS THEM IN CONVENIENT, ECONOMY PACKAGES!



SOME FAMED MURRAY SWITCHES IN WHICH MURRAY SOLDERLESS CONNECTORS HAVE BEEN STANDARD FOR YEARS

So strong that they'll take all the tightening you will ever give them. When they're *tight*, they HOLD—and electrical contact is absolute. You can insert the cable or wire from any of *three* directions. These speedily-installed Murray Solderless Connectors have been standard in Murray Switches for years. Metropolitan Device Corporation, Brooklyn, N. Y.

SOLDERLESS CONNECTORS *by* Murray

METRO[illegible]LITAN
DEVI[illegible]CO[illegible]
Brook[illegible]n, N.Y.

Send price sheet and complete listing of Solderless Connectors

Name _____

Address _____

_____

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

May 13, 1944 — Vol. 121, No. 20

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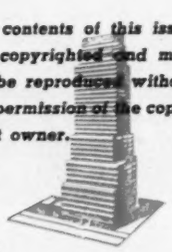

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From .....

.....

To .....

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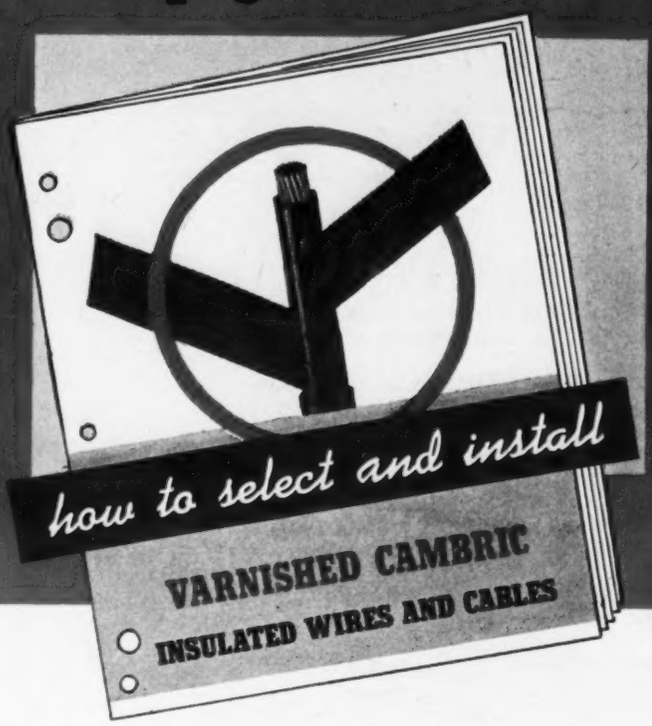
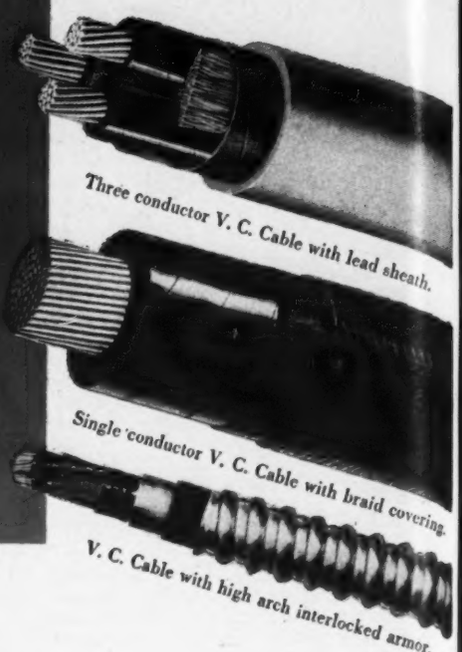
Signed .....

This 44 page Data Book tells



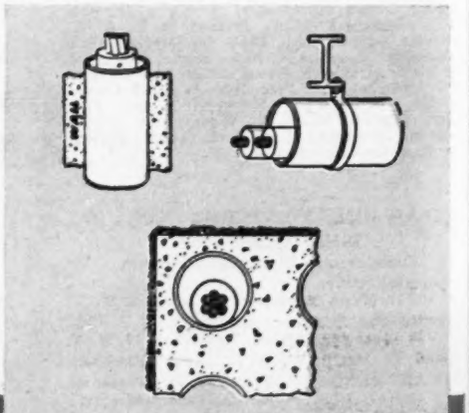

Three conductor V. C. Cable with lead sheath.
Single conductor V. C. Cable with braid covering.
V. C. Cable with high arch interlocked armor.

This book answers many questions which engineers encounter today and it is yours on request, with no obligation. In addition to the 40 pages of valuable data, there is a four page supplement on "Considerations for Increased Current Loadings Under Wartime Conditions." Material includes:

- 20 tables on Current Carrying Capacities.
- Tables of Diameters, Weights, etc., of 1, 2, and 3 Conductor Varnished Cambric Cables.
- 4 pages on how to splice and terminate.
- Charts on How to Select the Right Cable for various Conditions of Use.
- What Kinds of Protective Coverings to Use.
- Voltage Drop Tables and other helpful information.

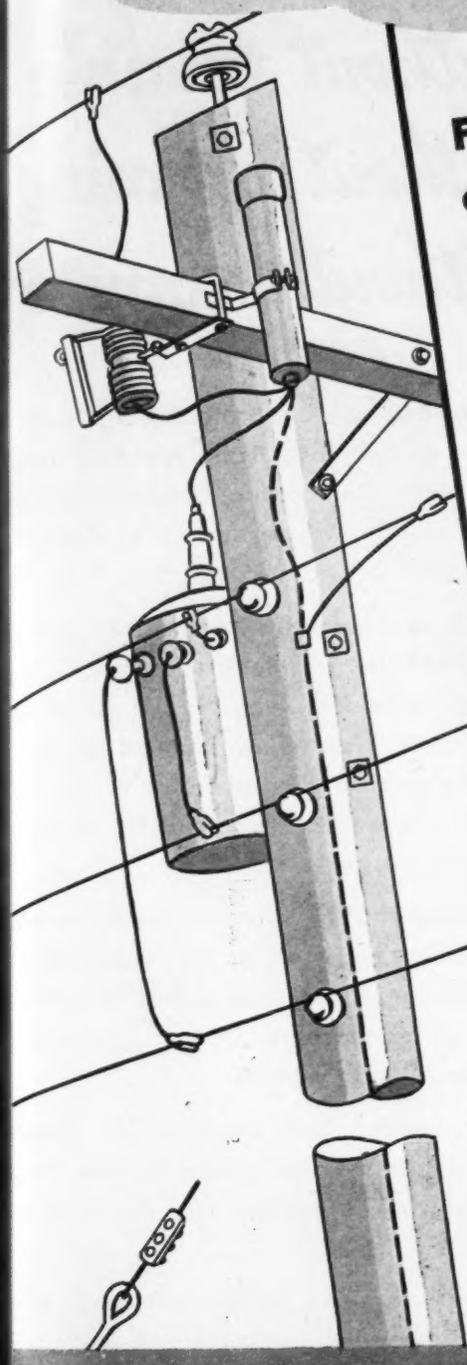
Write The Okonite Company, Passaic, New Jersey, for Bulletin OK-1013.

Many illustrations like these accompany the tables showing current carrying capacities of Varnished Cambric Cables in ducts, underground, and in the air, and help the engineer to quickly visualize conditions which he will encounter.



OKONITE OKONITE INSULATED WIRES AND CABLES

QUIZ: HOW MANY ITEMS OF MATERIAL ON THIS RURAL LINE STRUCTURE?



For all-inclusive service on pole-line needs.....

CALL YOUR GRAYBAR MAN

Suppose it were necessary to order the items on this pole-line structure from individual manufacturers? It would call for nearly a dozen separate orders, add to your paper work, slow down delivery and multiply the chances of confusion or error.

With GRAYBAR, you can place a single order for all the items that go together on the pole, through a local representative who is familiar with your requirements. On many standard items, you will get fast delivery from nearby warehouse stocks.

A GRAYBAR Man in your area is ready to make your pole-line supply problems his personal responsibility. Why not take advantage of his time-saving asssitance?

3536

ANSWER:

This structure, with customer transformer and service secondaries, includes 118 separate pieces of material, 28 different items, supplied by 11 manufacturers — via GRAYBAR.

BILL OF MATERIALS

1 – #3162 15" Galv. Pole Top Pin
1 – #38148 Pin Type Insulator
2 – #9808 5/8"x8" Galv. Bolts
3 – #9810 5/8"x10" Galv. Bolts
1 – #9812 5/8"x12" Galv. Bolts
7 – #7814 2¼"x 13/16" Galv. Sq. Bolt Hole Washer.
1 – #R104 Fir Crossarm
1 – #8128 Galv. Crossarm Brace
1 – #9634½ Galv. Carriage Bolt
1 – #9754 ½"x4" Galv. Lag Screw
5 – #165 S.C. Split Bolt Connector
1 – #9LA1DA185 Lightning Arrester with Bracket
1 – #9F3B1 Fused Cutout
1 – #22H94 7200/120/240 Type H 1½ KVA Transformer
1 – #S1725-CC Hot Line Clamp
55' – #6 Solid Bare Copper Wire
67 – #9 1½"x 3/16" Galv. Wire Staples
2 – 4-11-44 Wireholders
1 – #438 ALC Connector Copper to Galv. Wire Strand
2 – #7449 Galv. Guy Clamp
45' – 3/8" S.M. Double Galv. 7 Strand Guy Wire
2 – #7584 Galv. Guy Hook
2 – #7575 Galv. Strain Plate
8 – 8 penny Nails
1 – #4143 Bonding Clamp
1 – #6317 5/8"x7' Galv. Anchor Rod
1 – #836 8000# Steel 3-Way Expanding Anchor
1 – 35' Class 7 Southern Yelow Pine Pole, full length pressure treated

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Water *without* dirt—

without trouble
without cleaning
without stopping

ELLIOTT
Self-Cleaning
STRAINERS

Elliott self-cleaning strainers are going strong in all the industries that demand clean, dirt-free water. They clear water for cooling bearings, cooling transformers, cooling generator coils, supplying many other needs of widest range.

They make no demands upon anyone's time or attention, these Elliott self-cleaning strainers. They clean themselves, back-flushing the dirt out of section after section, isolated or blanked off by a slowly rotating element. Fibrous matter cannot mat or clog them, either — the design of the straining element provides against that.

They are themselves immune to ordinary trouble. Motor and driving gears are on top, out of harm's way. Lower bearing is water-lubricated, of a cutless design which dirt cannot harm. Operation is smooth, quiet, slow, and almost wearless.

Elliott also makes Twin Strainers for manual cleaning. One chamber always working. Also single strainers, used where occasional time-out for cleaning is permissible.

If you have a straining problem affecting water or any other liquid, ask us to work with you.

ELLIOTT COMPANY

Accessories Department, **JEANNETTE, PA.**

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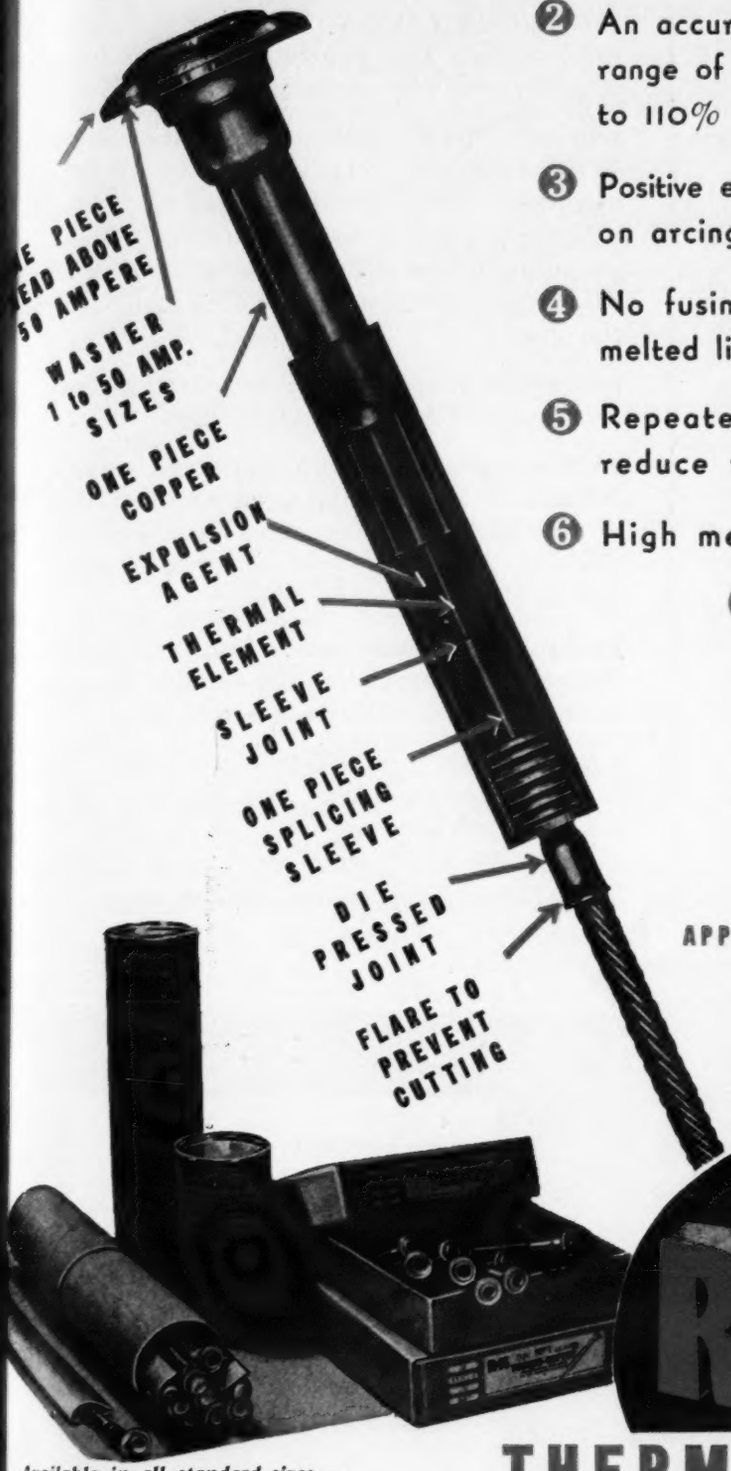
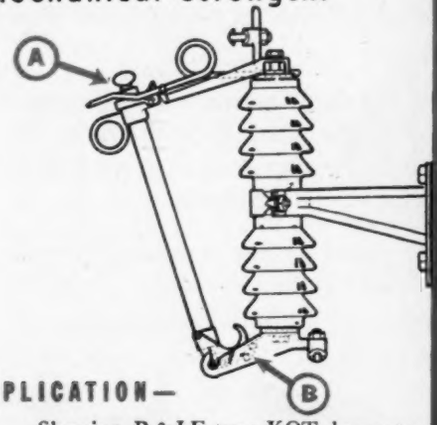
A-276

HECK the FACTS

1. Universal interrupting link—fits any type cutout.
2. An accurate interrupting link—range of operation to within 90 to 110% of time current curve.
3. Positive expulsion—not dependent on arcing.
4. No fusing element—no partly melted links. No strain wire.
5. Repeated overloads do not reduce rating.
6. High mechanical strength.





APPLICATION—

Showing R&IE type KOT dropout cutout. In service, thermo-rupter head is covered by cap screw "**A**". End of lead wire is clamped by thumb-screw "**B**" which holds tube in place until link is expelled.

Available in all standard sizes — one-half to two hundred amperes.

R&IE

THERMO-RUPTER

The Check List

- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- AIR BREAK SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SECTIONALIZING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

LWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

Compare new Ampac A-C WELDER with:

D-C WELDERS..

▶ Unlike d-c welders, Ampac a-c welder has *no arc blow!* That means welding speed is increased 15 to 30% on heavy work.

▶ Transformer type construction of a-c Ampac has both higher efficiency and lower idling loss than comparable m-g type welder.

▶ At no load the Ampac "400" idling loss is 200 watts—the idling loss of a typical m-g 400 amp d-c welder is 3100 watts. At 2¢ per kw/hr, the d-c unit wastes $1.49 in a full 24-hour day — Ampac's loss is less than 10¢!

▶ Initial cost of Ampac is lower — about 1/3 less than for a comparable d-c welder.

▶ Ampac's maintenance is lower because there are only three moving parts on the whole welder. There are *no* brushes to change—*no* commutator to dress.

▶ One control regulates entire welding output on Ampac a-c welder. Most d-c units have two or more controls. Result: Ampac saves adjustment time, helps speed production.

▶ Ampac can be used on any standard a-c voltage — 220-440 and 208 v, 60 cycle . . . without the extra expense of 3-phase installation as required by d-c welders.

OTHER A-C WELDERS..

▶ On Ampac — and Ampac alone — voltage is *automatically* raised for ideal arc striking at low currents. That provides perfect welding characteristics over entire range.

▶ Ampac's 3-piece core arrangement is exclusive among a-c welders. Provides basis for Ampac's high efficiency and low idling loss. Compared with the two largest selling 300 amp a-c welders, idling loss of the new Ampac "400" at no load is 14% lower than one, 61% lower than the other.

▶ Complete welding range is covered in only seven turns of Ampac's control wheel.

▶ Unlike many a-c welders, Ampac has handles, crane hooks and welding terminals that attach *directly* to the core. Case acts *only* as a protective shell. Damage to case cannot harm structure of electrical parts within.

▶ Ampac has no stray flux to heat up the case. Reactor coil surrounding the variable air gap forces every line of flux into active duty.

▶ Ampac "400" is the ideal size a-c welder. It's large enough to use 1/4" rods, 24 hours a day — which 300 amp units will *not* do. And the average 500 amp unit is rarely used at over 450 . . . while Ampac range is 50-500 amps.

♪ *Tune in the Boston Symphony, Blue Network, every Sat. Eve.*

GET COMPLETE FACTS on this great new Ampac a-c welder from your nearby Ampac dealer or Allis-Chalmers district office. Learn how its patented circuit cuts costs — increases production. Ask for bulletins B6241, B6302.

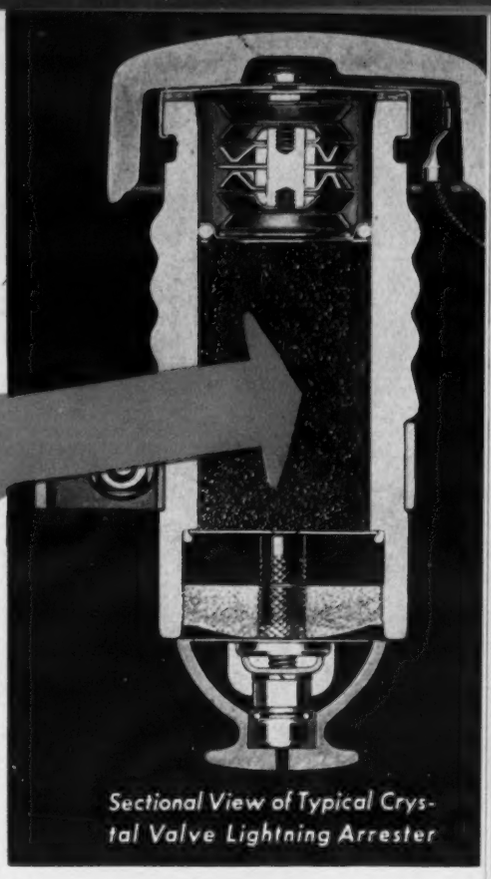
ALLIS-CHALMERS
MILWAUKEE 1, WISCONSIN

A 1702

OXIDIZED Silicon Carbide

TODAY'S MOST HIGHLY DEVELOPED VALVE ELEMENT

Used only and exclusively in Crystal Valve Lightning Arresters



Sectional View of Typical Crystal Valve Lightning Arrester

hat It Is—Initially a specially ocessed type of electrical silicon rbide. After crushing, washing, ng, etc., a special high-tempera- e chemical treatment provides ch crystal with a *thin, porous coat-* of silicon dioxide—SiO_2.

hat It Does—Since it was de- oped exclusively for lightning ar- ter usage, its electrical character- cs, such as resistance and valve ion, are especially adapted to htning arrester operation. These ovide Crystal Valve arresters with:

Low IR voltage drop and ample surge voltage reduction, with adequate surge energy absorption.

Heavy-duty surge discharge capacity.

Extremely marked valve action for follow current interruption.

Long life, since no measurable deterioration of Crystal Valve arresters occurs after years of normal service.

No material so far developed for the valve element of lightning arresters has advantages and characteristics as definitely outstanding as does Oxidized Silicon Carbide grain; it is because of this, plus our experience of more than 50 years in the lightning arrester field, that Crystal Valves embody in such marked degree the desirable features of valve type lightning arresters and have therefore afforded such superior protection to equipment and service.

Where arrester performance must be critical and exacting; where it must be depended upon absolutely—the Crystal Valve is definitely indicated.

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Former name—Electric Service Supplies Co.

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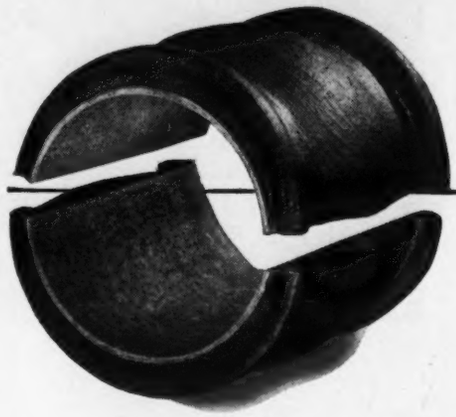
Stocks Located at Strategic Points for Quick Delivery

Illustrated below are Silicon Carbide Grains Enlarged 100 Diameters—but Note the Difference

***Oxidized* Silicon Carbide Crystal—a specially processed type of silicon carbide *used only and exclusively,* in discrete form, for the valve element of Crystal Valve lightning arresters.**

Typical Silicon Carbide Crystal—used for many years both in discrete and bonded forms as the material generally used for the valve element of lightning arresters.

CRYSTAL VALVE LIGHTNING ARRESTERS



There are many grades and types of INSUROK, one or more of which will meet practically every mechanical, electrical and chemical requirement.

INSUROK brake beam bearings, four in a series, are used on each truck.

"THANKS FOR THE SMOOTHER RIDE"

INSUROK bearings are now used on the Chicago Surface Lines' newest street cars.

Bearings by The Richardson Company are made of a combination of molded soft rubber and Laminated INSUROK. INSUROK forms the bearing surface and because this particular grade of INSUROK has a high graphite content, friction is reduced to a minimum—thus permitting smoother starting, travel and stopping. They also eliminate the noise that resulted from the bearings made of other materials, formerly used. And they last ten times longer, thus reducing maintenance and replacement costs.

INSUROK, both Molded and Laminated, as well as combinations, is being used for parts and complete products by practically every industry. If you have a problem that INSUROK might solve, why not let an experienced Richardson Plastician help you? Just write for complete information.

INSUROK *Precision Plastics*

The RICHARDSON COMPANY

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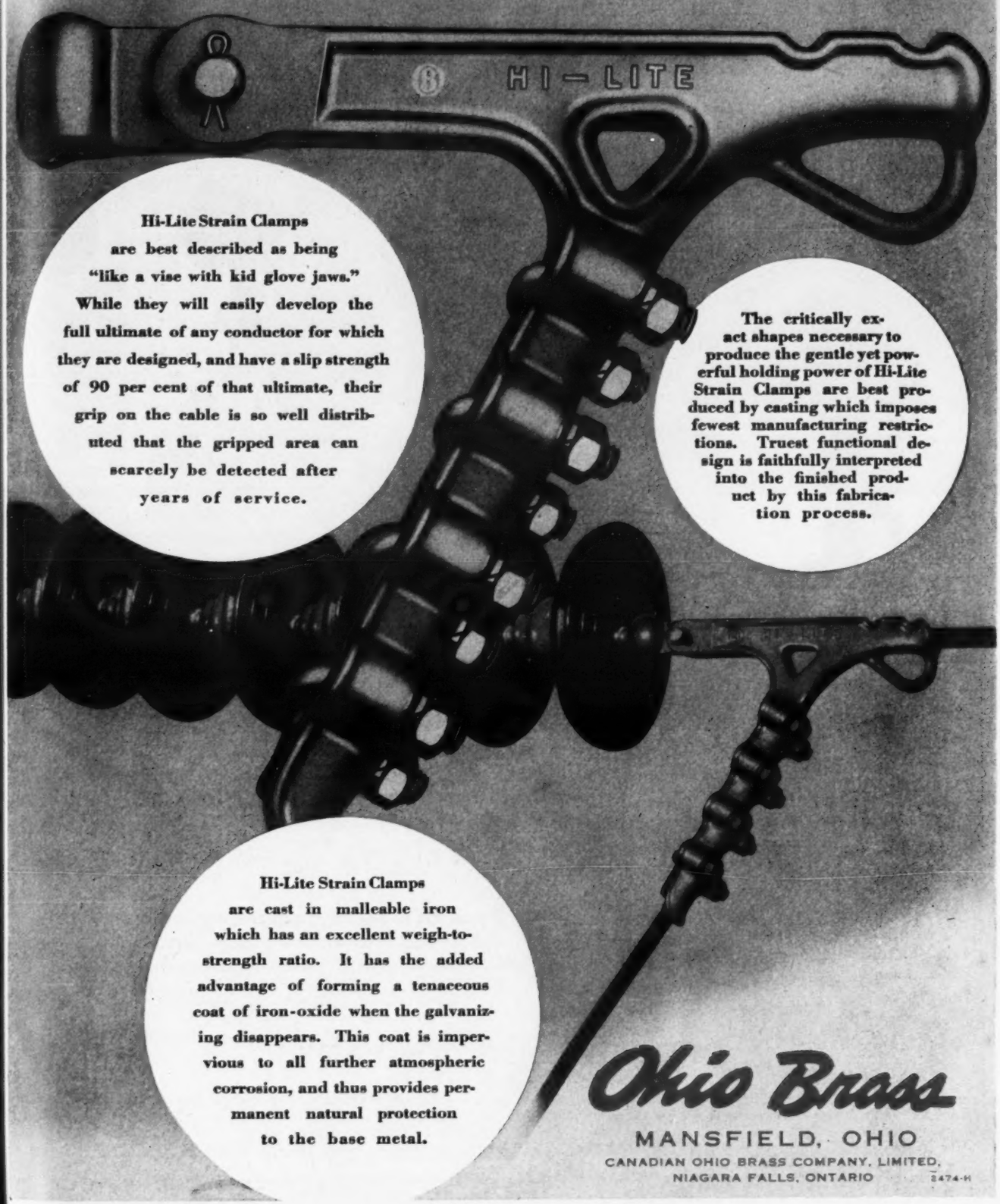
How And Why The Hi-Lite Clamp Works



Hi-Lite Strain Clamps are best described as being "like a vise with kid glove jaws." While they will easily develop the full ultimate of any conductor for which they are designed, and have a slip strength of 90 per cent of that ultimate, their grip on the cable is so well distributed that the gripped area can scarcely be detected after years of service.

The critically exact shapes necessary to produce the gentle yet powerful holding power of Hi-Lite Strain Clamps are best produced by casting which imposes fewest manufacturing restrictions. Truest functional design is faithfully interpreted into the finished product by this fabrication process.

Hi-Lite Strain Clamps are cast in malleable iron which has an excellent weigh-to-strength ratio. It has the added advantage of forming a tenaceous coat of iron-oxide when the galvanizing disappears. This coat is impervious to all further atmospheric corrosion, and thus provides permanent natural protection to the base metal.

Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS COMPANY, LIMITED,
NIAGARA FALLS, ONTARIO

3474-H

CROUSE-HINDS

Explosion-Proof and Dust-Tight

Industrial Signal Condulets

(CONDULETS are manufactured only by CROUSE-HINDS)

Type ETH
Siren Signal

Type ETH
Howler Signal

Type ETR
Bell Signal

For hazardous locations in oil refineries and tankers; rubber plants; paint, varnish, plastics or chemical plants; grain elevators; mines; powder mills or arsenals; and other locations where highly flammable substances are manufactured, used or stored.

For use in noisy places or where signals must be heard from a distance.

Plain or coded signals, alone or in connection with a telephone

Alarms: for fire; changes in liquid levels, gas or air pressures.

Factory sealed; with pigtails in an explosion-proof junction Condulet for splicing to line wires.

Type ETH Siren and Howler Signals. 6 to 250-volt A. C. or D. C.

Type ETR Bell Signals. Continuous vibration; 110-volt Universal motor. Single stroke; 110-volt, 60-cycle A. C. Solenoid operation.

Listed in Condulet Catalog No. 2500, Section 85, Page 12C

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HOW O-B SUSPENSION INSULATORS

HELP MAKE ENGINEERING DESIGNS WORK

Steel structures, cables, footings, and all the other items in building a transmission line are accurately engineered. Doesn't it seem a little illogical to evaluate as vital a thing as an insulator string at "somewhere around 13,000 pounds", or whatever other figure you may want?...This is the case when suspension insulator units are rated on the basis of *average strength*--an average of thousands that might possibly not apply to any one of the eight or ten units in a certain string; and that completely conceals the occasional substandard unit whose presence is admitted in arriving at an average. Yet the one weak unit is by far the most important for, while it may take thousands of insulators to hold up a line, it takes just one to drop it!...There are two things you can do about this. You can specify higher average strength than you need, and pay a premium for it, only to be just a little more sure of getting sufficient strength. Or, you can specify O-B suspension insulators which are individually and permanently marked with a *minimum strength* rating that applies to every single unit. On this sound and specific strength rating, you can base engineering designs that will work!...Specify O-B and get the kind of strength that *counts*, because you can *count* on it.

2473-H

Ohio Brass

MANSFIELD, OHIO, U.S.A.

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONTARIO

Synthetic Rubber Replaces NATURAL RUBBER INSULATIONS AND SHEATHS ON SIMPLEX WIRES AND CABLES

Early in the war the scarcity of natural rubber made conservation necessary in order to make the best use of what was available. Our standards of quality and service had to be maintained with less rubber than we had been using. A few months ago, because of the rapidly dwindling supply of natural rubber, a complete change to synthetic rubber became imperative. Natural rubber could no longer be used in conductor insulation or cable sheath.

In anticipation of just such a situation, we already had investigated available substitute materials and were well along in the development of insulations and sheaths to replace all of our standard natural rubber compounds. The change-over is now practically complete.

A synthetic rubber compound has been provided to replace each of our special purpose, natural rubber insulations and sheaths. Laboratory tests and service records already indicate that they may be depended upon for trouble-free, efficient service. The technical and engineering skill that made our natural rubber compounds outstanding is now focused on obtaining even better quality and service with the new synthetic compounds.

If your postwar plans call for insulated wires and cables, or if you need them now for essential war work, it will be well worth your while to learn more about Simplex wires and cables with their new synthetic insulations and sheaths.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

Simplex WIRES and CABLES

NO EXCUSES FOR UNNECESSARY OUTAGES

Service Interruptions Mean War Production Interruptions

● You can less afford unnecessary outages today than ever before. Man-power and time of servicing and replacing blown links make this prohibitive.

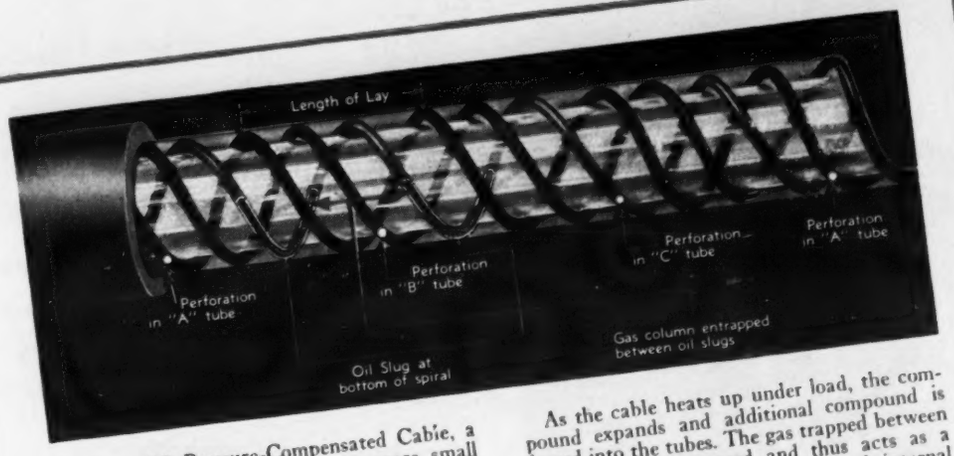
The elements of S & C Links are designed and constructed of silver, like the time-proven elements used in S & C Power Fuses. They *reduce unnecessary outages* and save time because they have:

★ **High surge capacity**
★ **Resistance to corrosion and deterioration**
★ **Uniform quality**
★ **Sustained accuracy of time-current characteristics**
★ **Greater mechanical strength**

S & C Universal Silver Fuse Links will save man-hours, truck-miles, and customer complaints. Can be used in all manufacturers' cutouts. Deliveries made from stock.

SCHWEITZER & CONRAD, INC.
4435 Ravenswood Avenue Chicago, Illinois
Manufactured in Canada by Powerlite Devices, Ltd., Toronto, Ontario

"Gas Cushion" makes life easier


Length of Lay
Perforation in "A" tube
Perforation in "B" tube
Perforation in "C" tube
Perforation in "A" tube
Oil Slug at bottom of spiral
Gas column entrapped between oil slugs

In Type PC Pressure-Compensated Cable, a gas cushion provided by one or more small tubes included in the impregnated fillers, stabilizes operating pressures within fixed limits. The schematic diagram above shows clearly how it functions.

The helical tubes, perforated at intervals of about four times the length of lay, are filled with dry nitrogen gas. During manufacture, some of the insulating compound is forced into the perforations.

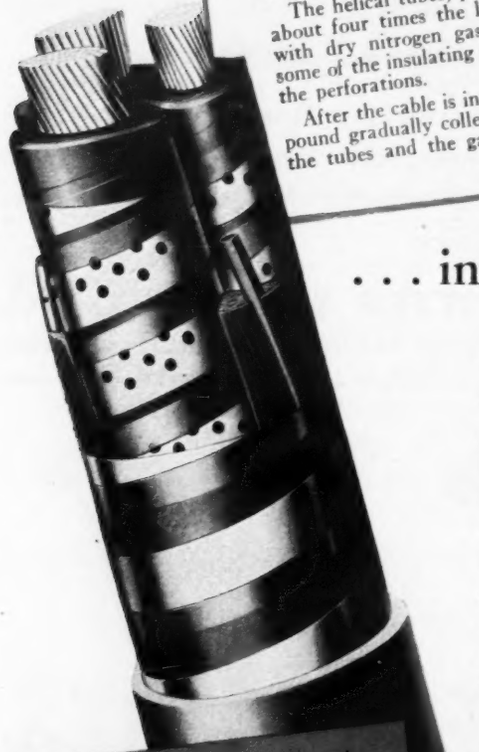
After the cable is installed, slugs of the compound gradually collect in the low portions of the tubes and the gas collects in the domes.

As the cable heats up under load, the compound expands and additional compound is forced into the tubes. The gas trapped between the slugs is compressed and thus acts as a cushion to prevent development of internal pressures which would ordinarily stretch the lead sheath.

In this way, points of concentrated pressure are avoided. Pressure remains uniform and evenly distributed along the entire cable.

When the cable cools, the oil saturant contracts and the compressed gas forces the excess oil back into the cable, thus preventing wide swings from pressure to vacuum.

. . . in NEW paper insulated power cable



TYPE PC PRESSURE COMPENSATED CABLE

IN a paper insulated cable of the conventional "solid" type, expansion of the lead sheath followed by contraction of the insulation under the thermal cycles of normal operation brings about the formation of voids inside the cable. The resulting ionization discharges within the voids cause rapid deterioration of both paper and insulating compound.

Type PC Pressure-Compensated Cable prevents formation of such voids; and does it without any radical change in basic construction, without highly special accessories, without complicated methods of installation and without high maintenance expense. Type PC Cable offers, in effect, a conventional cable —with the addition of a simple pressure-compensating gas cushion which holds the internal operating pressures within fixed limits.

A bulletin on PC Cable is available. Send for your copy.

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

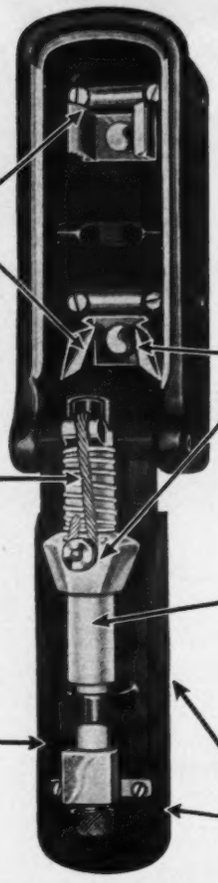
USS

UNITED STATES STEEL

LOWER HEAT RISE
NO BURNED CONTACTS
SURE INDICATION

Substantially built!
Two sizes:
50 amps., 5 KV
50 amps., 7⅛/12⅛ KV

Door stays closed!
Dirt, rain, snow
and ice stay out
but it indicates!



Old fashioned tried and true area contacts of phosphor bronze prevent excessive heat rise.

Wedge contacts take up ⅜ inch slack if carelessly left in links, and provide recoil on shorts.

Stainless steel spring puts normal tension of less than 2½ pounds on link, therefore no over-tensioning of links.

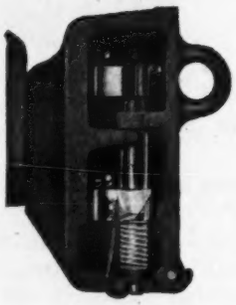
Shows fuseholder properly fused and ready to be closed in to housing. Door is easily attached in this position.

Fuseholder and door are removed or replaced as a unit. The door does not drop out.

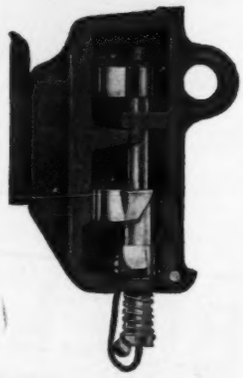
Note the clean simplicity and absence of weak or complicated parts or mechanisms.

STREAMLINED

Conserve vital metals, yet
comply with all NEMA Cutout Standards.
No other Porcelain Housed Primary
Cutouts give you as many advantages
as these time-tested Dropdown
Indicating Type Matthews Cutouts
Send for Bulletin 103
Try them at our risk.



Phantomized to show
closed position ready
to operate



Shows indicating position
with Fuse Link
separated

W. N. MATTHEWS CORPORATION, ST. LOUIS, U. S. A.

Engineers and Manufacturers Since 1899

NO OTHER SWITCH HAS THESE TWO GREAT FEATURES

INSIDE—*note the trim compactness and ample wiring space.*

OUTSIDE — *modernly streamlined cover with rocker design handle.*

All BullDog Safety Switches have two important (and exclusive) advantages which assure more positive action, greater safety and longer life.

First, the Vacu-Break principle gives arcs no space in which to breathe — snuffs them out before they start.

Second, the Clampmatic mechanism — bolt-tight in the ON position—makes possible an easy, quick release when thrown OFF. This is accomplished by the energy stored in the clamp springs which help the handle operating spring "break" the contacts with almost automatic ease.

Send for descriptive Bulletin No. 415, giving complete information.

BULLDOG
ELECTRIC PRODUCTS CO.

BOX 177, R. PK. ANNEX
DETROIT 32, MICHIGAN
BullDog Electric Products of Canada, Ltd., Toronto, Ont.

Field Engineering Offices in All Principal Cities

ALSO MANUFACTURERS OF

SAFTOFUSE PANELBOARDS · SWITCHBOARDS · CIRCUIT MASTER BREAKERS · BUSTRIBUTION DUCT, *for "plug-in" power* **· UNIVERSAL TROL-E-DUCT,** *for flexible lighting* **· INDUSTRIAL TROL-E-DUCT,** *for movable "loads."*

BUY MORE WAR BONDS

INVASION *and the* FINAL CHALLENGE

The idea that our national security some day would depend upon the successful invasion of continental Europe by our armed forces was inconceivable to the average American but a few short years ago. Yet, today our whole strength is assembled to that very action and for assuring a sound and permanent peace.

America became great without aggression . . . without tyranny. Our greatness has been achieved without destroying others . . . ours is a history of unprecedented industrial progress, of development of our own resources and reliance on our own efforts.

Aggression is foreign to American philosophy. Yet, today we find ourselves faced with the choice of destroying or being destroyed. Today we are confronted by the hard fact that the kind of peace which we all so fervently desire can be achieved only by crushing autocracy and by removing the causes of aggression.

We are now engaged in the accomplishment of the first objective. Since Pearl Harbor a complacent, peace-loving America—the largest of the "soft" and "decadent" democracies—has grown strong and tough. Out of the inherent virility of a free people we have moulded the mightiest force for invasion and attack that the world has ever seen.

We have reached our peak rates of war production. We are producing as much war equipment as all the rest of the world combined.

History will record our industrial mobilization as a phenomenal achievement.

The battle of production has been won!

The full might of our armed forces and those of our allies unleashed against the Axis war machine will bring eventual victory. Two and a half years of intensive preparation, backed by 168 years of growth as a free nation, has given us superiority over twenty years of painstaking preparation by the totalitarian and militaristic countries with their enslaved peoples.

Every American has contributed toward this powerful offensive. Our manufacturers and business leaders have exerted their fullest efforts. Our industries have mobilized their tremendous resources—tapped to the fullest degree their inventive and productive genius. The men and women in the factories, on the farms, and in the mills and mines have played a magnificent

part in the tremendous production program. Citizens all are making their contribution to the armed victory that lies ahead

We have demonstrated that a free people under a free enterprise economy can unite in a common purpose.

* * *

When the war is won, we shall be faced by our second objective . . . removing the causes of aggression. This is a social challenge. A challenge to those who would sacrifice our democratic way of life for personal gains or foreign ideologies.

The best insurance for the continuance of our democracy is a successful democracy. That means a dynamic and not a static democracy. All of us who want to preserve the ideals that have made America . . . and that includes all but a handful of extremists . . . must determine to find the policies and programs which will permit us to make the most of the abundance nature has provided for us.

To achieve this end we must recognize the fact that we are but a wheel in the machinery of world economy. A wheel that must drive or be driven. A wheel that must mesh smoothly with the many other wheels or be stripped of its cogs.

We are the only nation on earth free enough and strong enough to shape the mould of its own destiny. We can be hampered by nothing but our own confusion.

* * *

The mind and the heart of all America today brood over the shores of Britain and watch over the narrow waters that wash the beaches of the Continent. And the prayers of all America go with each of those who embark upon that epic passage.

Those of us at home who are producing the fighting tools and who are so earnestly concerned with the problems that will face a postwar America, should see now, even if we may never have seen it before, that all our plans will be worth just exactly what the men and women who make that passage are prepared, competent, and inspired by their leadership to make them worth.

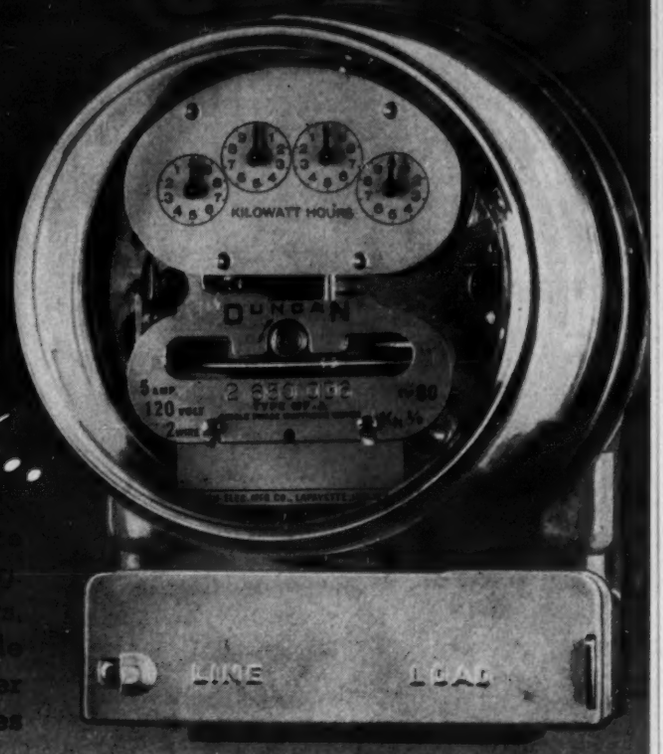
For those men and women are America!

They have gone out from rich homes and poor homes alike, from farms and factories, from schools and churches, from mines and ranches, from offices and studios, to take their places in the battle line. They are a cross-section of the America that is to be.

Whoever may draw the plans for that America, it is those men and women who will make the plans good. Invasion is their first step toward that end. May their work be speedily done, and may our plans be worthy of that work.

President, McGraw-Hill Publishing Company, Inc.

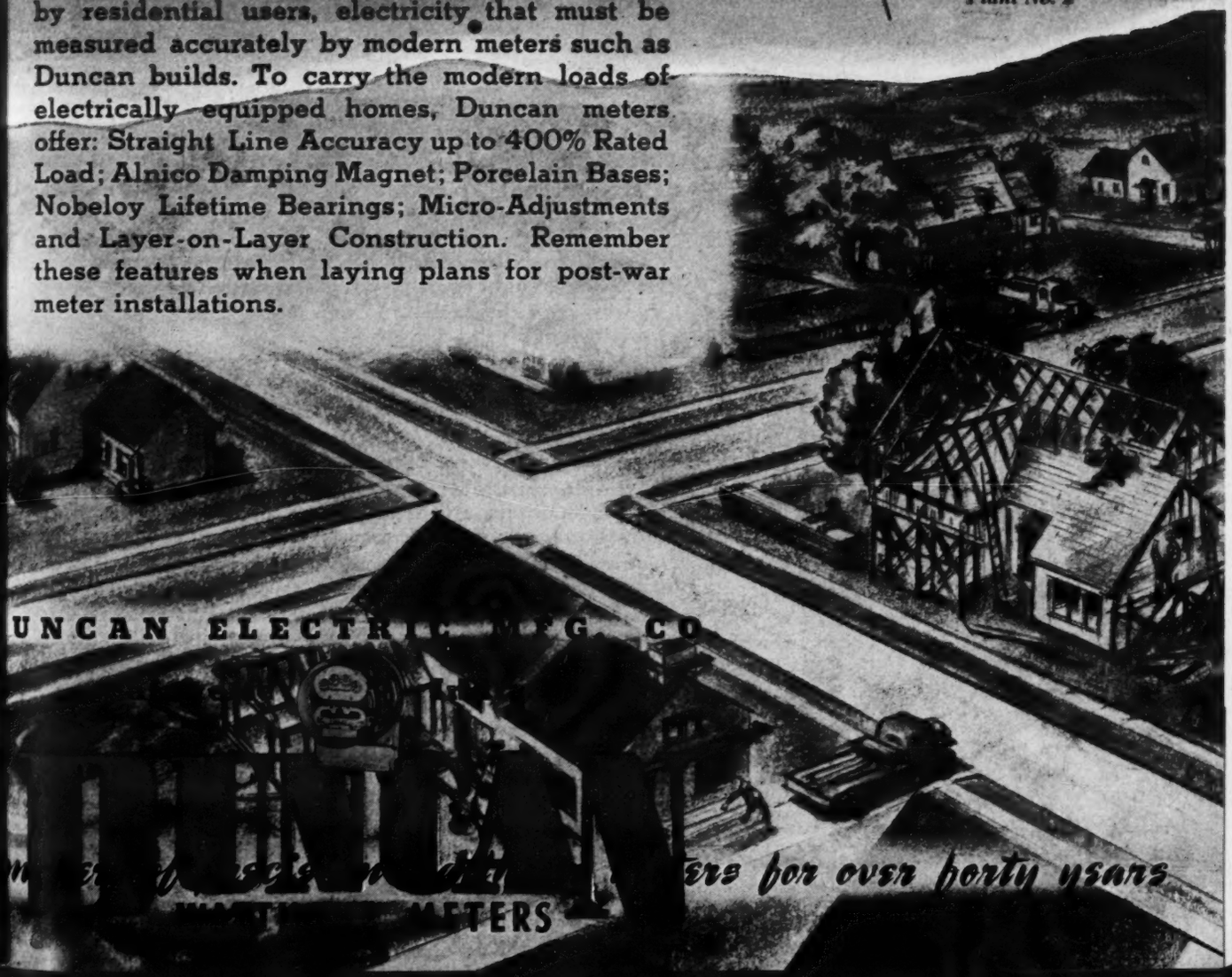
THE MODERN METER for *tomorrow's homes...*



The major part of the equipment which will make these modern homes convenient and liveable will be electrically powered. This means greater than ever consumption of electricity by residential users, electricity that must be measured accurately by modern meters such as Duncan builds. To carry the modern loads of electrically equipped homes, Duncan meters offer: Straight Line Accuracy up to 400% Rated Load; Alnico Damping Magnet; Porcelain Bases; Nobeloy Lifetime Bearings; Micro-Adjustments and Layer-on-Layer Construction. Remember these features when laying plans for post-war meter installations.

ARMY E NAVY *Plant No. 1*

ARMY E NAVY *Plant No. 2*



UNCAN ELECTR[illegible] G CO

[illegible]ers for over forty years

METERS

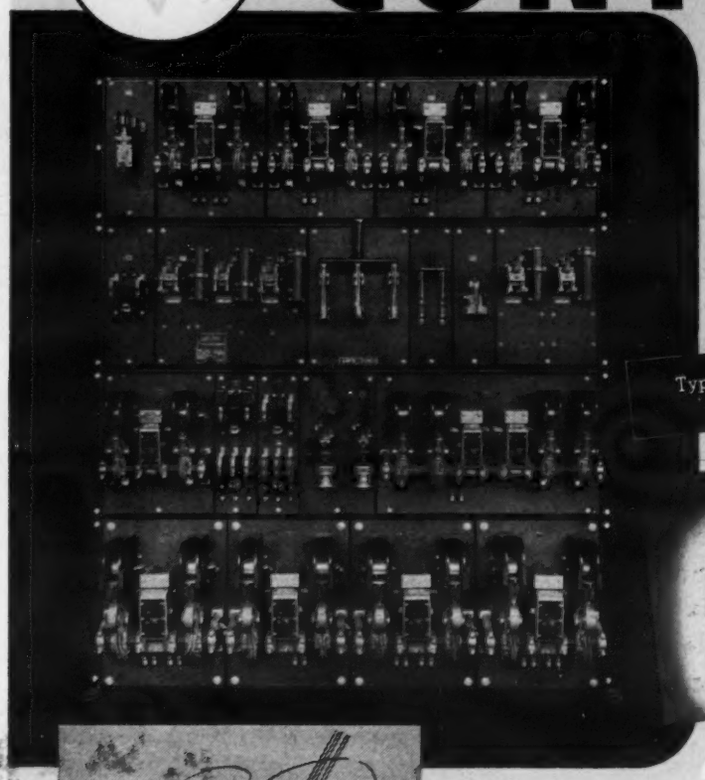
A NEW ALL A-c HOIST CONTROLLER BY EC&M

CONTRADYNE

(TRADE MARK)

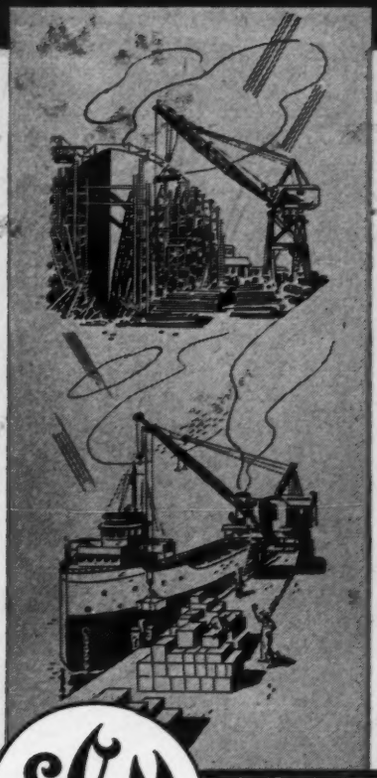
FOR SHIPWAY, FLOATING DRYDOCK, CARGO-HANDLING CRANES, ETC.

. . . A Selective System offering a wide range of speed regulation for all loads



Typical EC&M CONTRADYNE Controller for the hoist motions of A-c cranes.

Compact Type NT Master Switch. Narrow width permits close grouping of master switches for all motions within convenient reach of the operator.



Again

EC&M presents a new method of control for A-c crane hoist operation. Unlike any previous A-c hoist control, this controller has the following outstanding advantages:

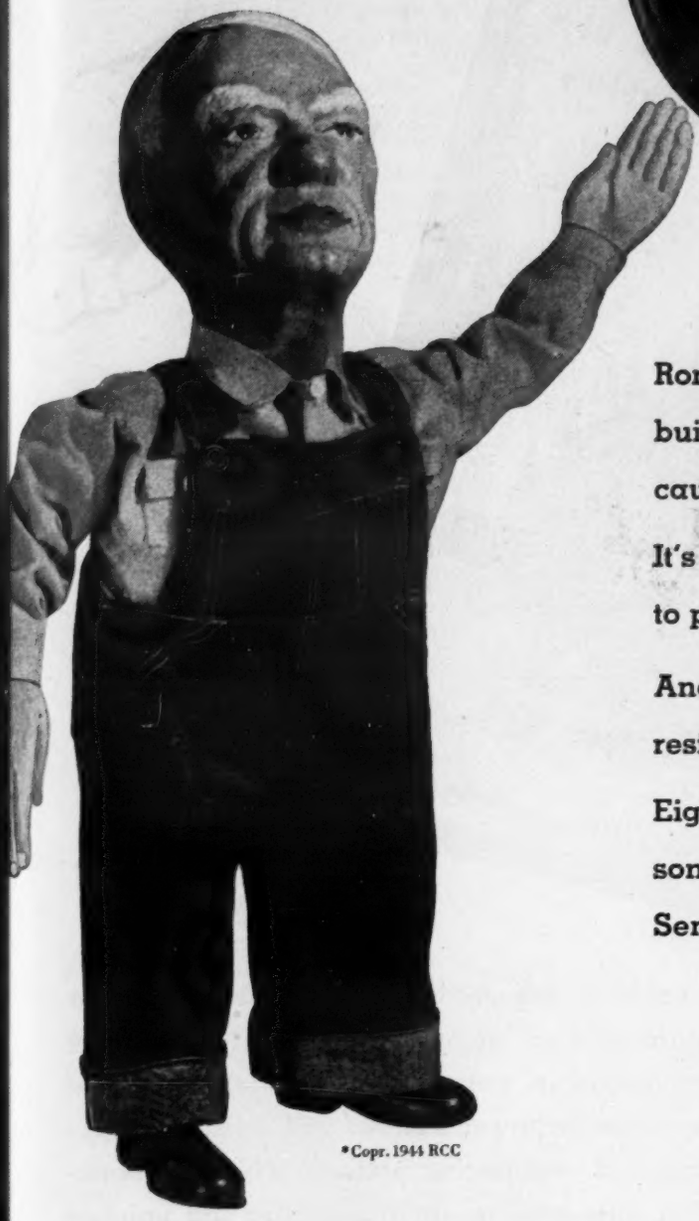
1. Provides all the well-known advantages of the EC&M A-c dynamic lowering control for accurate handling of average crane loads (light loads or the empty hook).
2. Permits smooth regulation in the lowering of overhauling loads through long distances.
3. Used with a standard A-c wound-rotor crane motor and is operated directly from the A-c source of power without mechanical load brake or rotating conversion units.
4. Operator has control of the load at all times—brake sets instantly upon power failure or at will of the operator.
5. A simple controller of standard contactors and relays, easy to maintain and which, according to experience, requires only occasional inspection.
6. Compact and easy to install, saving valuable mounting space.

These efficient CONTRADYNE Controllers are already in successful operation on many cranes on prominent ship construction projects. Our nearby office will gladly explain the merits of CONTRADYNE Control for A-c service.

THE ELECTRIC CONTROLLER & MFG. CO.

2698 EAST 79th STREET CLEVELAND 4, OHIO

Make it pay— Be a Clock Watcher" says *Romey



*Copr. 1944 RCC

Rome SYNTHINOL—synthetic resin-covered building wire—saves time on the job because it's a "fast worker."

It's lighter . . smaller in diameter . . easier to pull . . freer stripping . . easier to splice.

And it's acid . . . alkali . . . moisture and oil resistant.

Eight distinctive colors are stocked. Reasonably prompt shipments can be made. Send us your inquiries.

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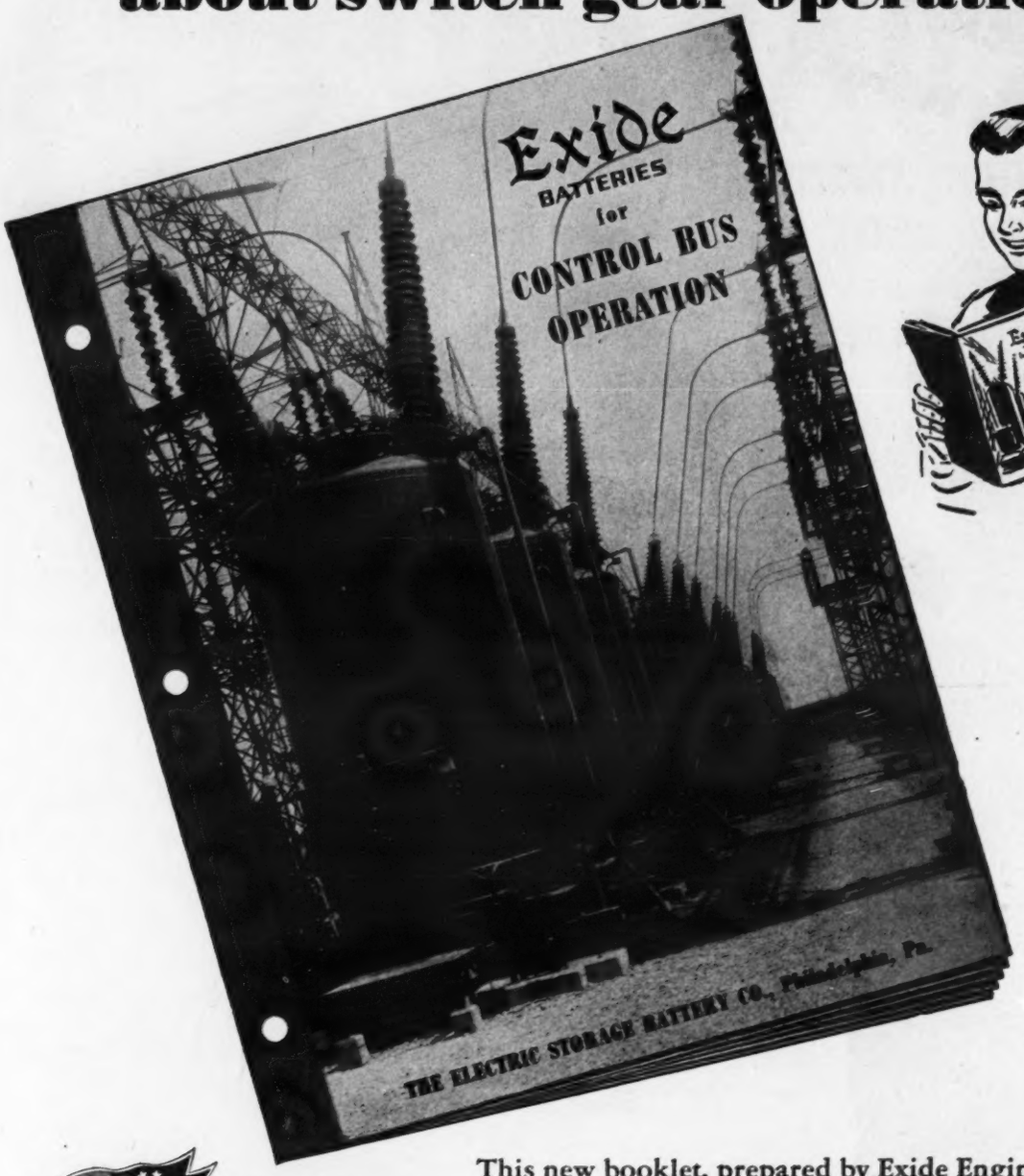
FROM BAR TO FINISHED WIRE

ROME CABLE
CORPORATION
ROME • NEW YORK

"Just what I wanted to know about switch gear operation."



ARMY E NAVY

Exide
CHLORIDE
BATTERIES

Exide makes several types of storage batteries for control bus operation, the most popular of which is the Exide-Chloride Battery. Exide-Chlorides have earned the confidence of engineers everywhere, and their widespread use in public utilities and private industrial plants is proof of their dependability.

This new booklet, prepared by Exide Engineers, contains factual information of interest to all engineers engaged in the application of switch gear. The installation of storage batteries in power stations and substations has become standard engineering practice. This new booklet not only tells how to attain adequate and uninterrupted current supply, but gives complete information on types of batteries used . . . selection of battery . . . method of operation . . . maintenance and charging . . . and many other facts you should know. If you are interested, write for a FREE copy today.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

(Here's another ad in the series that brings a vital message to your customers.)

What wonders do you see in store for the

POSTWAR ELECTRICAL HOME?

Television? Air conditioning? Automatic kitchens? Electronic devices to make heating, lighting, cleaning—in fact, homekeeping—far easier than ever before? Yes, but hold on a second . . .

Something else has got to precede them all! Electrical wiring—better wiring—adequate wiring. Without it no home or plant or business can begin to utilize all the coming electrical possibilities. And now is the time to plan for it—in advance.

Wiring has to come first—then why not put it in the forefront of your postwar thinking? Talk to the power engineer of your local utility, your electrical contractor, and get their ideas.

Remember . . . *unwired* planning will cost you a whole lot more than *planned wiring!*

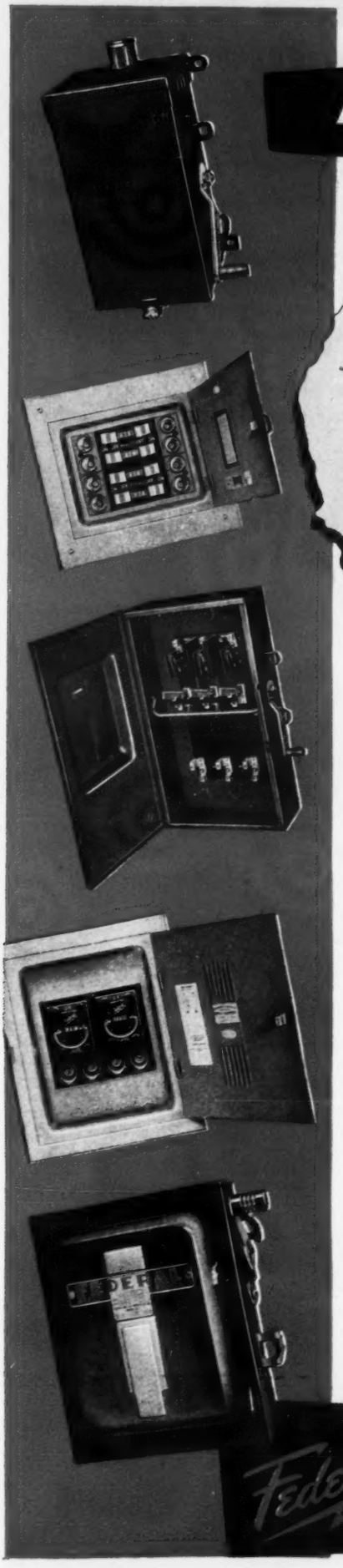
44218

ANACONDA

ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4 . . . Sales Offices in Principal Cities

Electrical Wires and Cables of Copper are the Life Lines of our Nation



ALL OVER THE MAP...

THERE'S A Federal MAN NEAR YOU!

More than ever before, service to customers is vital. Sound representation, strategically located, is an important factor in attaining this end. Fifteen nationwide branches of Federal, staffed by men who know your needs and are skilled in the knowledge of what our products can do for you, are at your call.

If you have any electrical problems involving safety switches, panel boards, switchboards or circuit breakers, please call upon the nearest Federal office for suggestions, without obligation.

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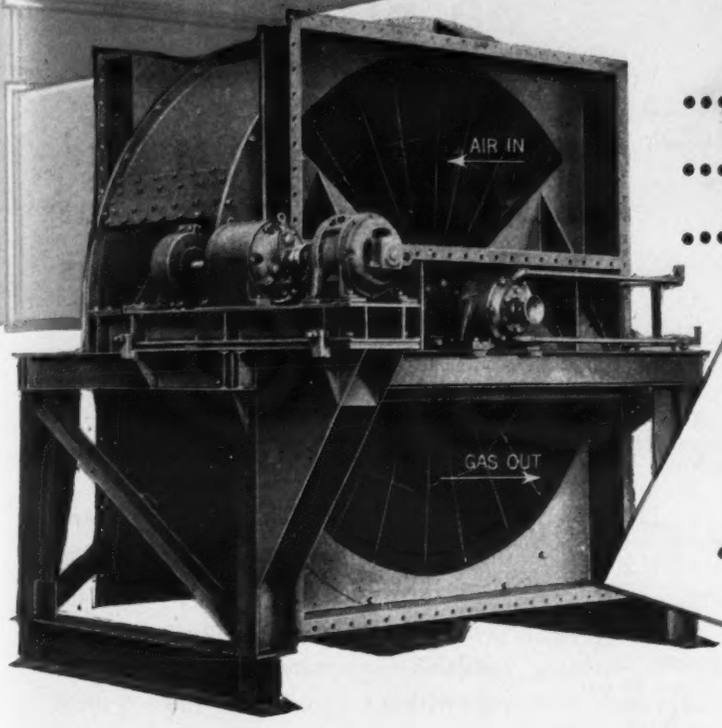
Federal ELECTRIC PRODUCTS COMPANY, INC.
50 PARIS STREET · NEWARK, NEW JERSEY
SAFETY SWITCHES · PANELBOARDS · SWITCHBOARDS · CIRCUIT BREAKERS

Can You Use AIR AT 1000°F



...to improve combustion?
...to increase heat recovery?
...to save fuel—save steel?

LJUNGSTROM Air Preheaters in high-temperature construction handle hot gases up to 1700° F, heating air to 1000° or more.

WARTIME DEMAND FOR CONSERVATION has given impetus to heat-recovery at higher temperatures than normally encountered in steam generating plants. Applied to cracking-still furnaces, for example, they may permit reduction or elimination of the convection tube bank, after the gas leaves the radiant section. Applied to roasting furnaces, they can increase combustion temperatures to maintain efficient furnace conditions.

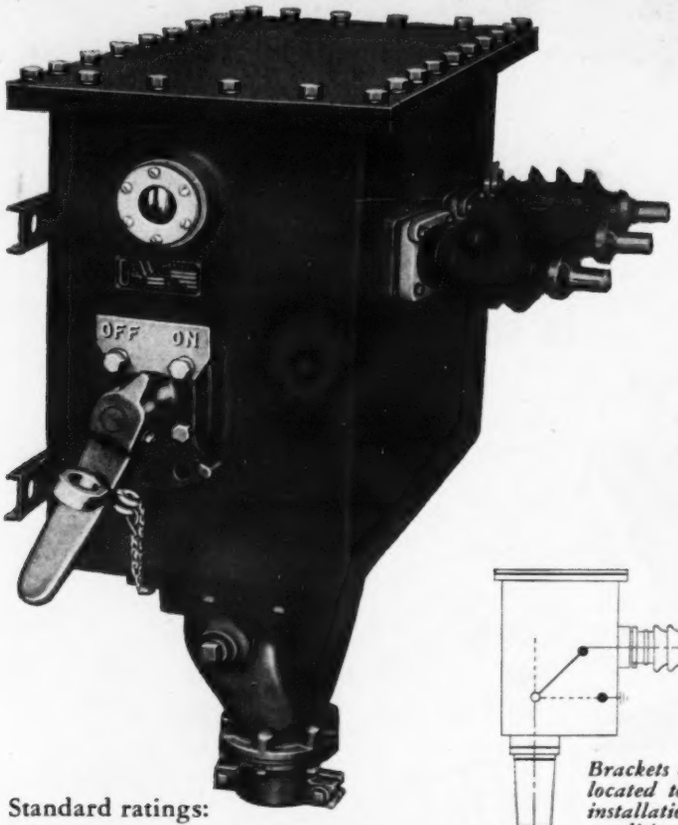
OUR EXPERIENCE IN PRE-HEAT ENGINEERING at these high-temperature conditions, offers real benefits to you, whatever the temperature-range of your installation. Thermal and mechanical problems solved for 1500° jobs add to service continuity and long life at more conventional temperatures.

LEADING BOILER MANUFACTURERS AND CONSULTANTS are prepared to incorporate Ljungstrom Air Preheaters as an integral part of high-efficiency furnace design. Leading oil refinery engineers regularly specify their use. Our staff will work closely with you in applying pre-heat to new or unusual problems requiring gas-to-air heat transfer. For further information write:

THE AIR PREHEATER CORPORATION

Executive Offices: 60 East 42nd Street, New York 17, N. Y.

"You will like this poletop switch-pothead"

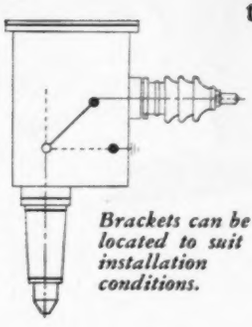


G & W TYPE "RA-MP" OIL DISCONNECT

(Safe and convenient)

Manually operated load break disconnection of underground cable circuits from overhead lines.

Metal enclosed water-tight construction with unit sealed cable pothead.



Brackets can be located to suit installation conditions.

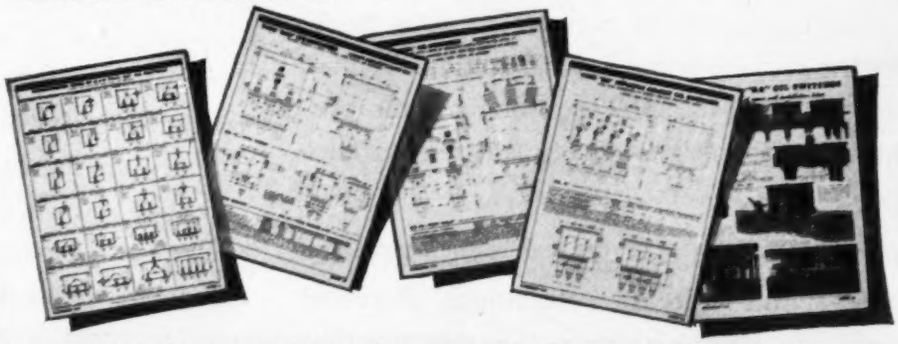
Gang-operated disconnection by means of an external handle which is provided with position stops and padlocking eyes. Remote control mechanism is available for operating the oil disconnect without climbing the pole. A third position of links for grounding the cable conductors is optional.

Standard ratings:

3 pole, 7500 volts, 400 amperes.
3 pole, 15000 volts, 400 amperes.

Send for new Bulletin No. 743

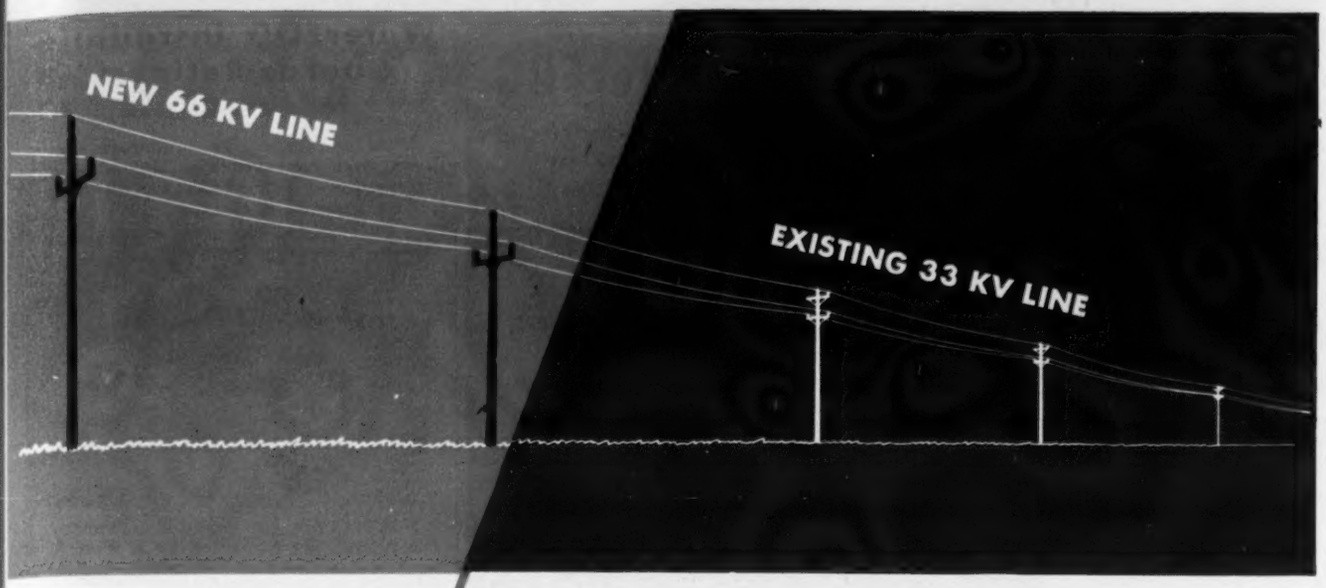
36 pages with illustrations, prices and detailed dimensions of various forms of G & W TYPE "RA" oil switches and transformer disconnects.



WRITE DIRECT OR GET IN TOUCH WITH OUR NEAREST REPRESENTATIVE

G & W ELECTRIC SPECIALTY CO., 7780 DANTE AVE., CHICAGO 19, ILL., U.S.A.

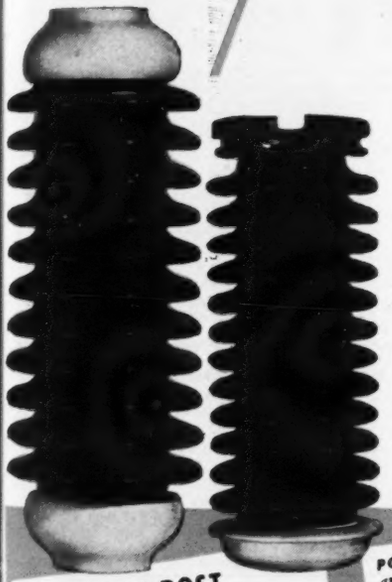
IN CANADA—POWERLITE DEVICES, LTD., TORONTO



LINE CONVERSION WITH LAPP LINE POSTS

is the fastest way to fortify your system . . . . and uses least materials

New or increased load demands frequently can most efficiently be handled by conversion of existing lines to higher voltage. For this job, Lapp Line Posts are particularly suited. Using present sound poles and conductors, conversion to higher voltages can be accomplished with no more than new cross-arms and Lapp Line Posts. Nor need such construction be considered as an emergency temporary expedient. Such a line approaches the current ideal for a new line; and your Lapp Posts can be expected to give trouble-free service for a longer period of years than you ever got from conventional insulators.



LAPP LINE POST and STATION POSTS on your system offer . .

POWER ARCOVER. *Flashover and leakage distances are not appreciably lowered by damage —even loss of several petticoats.*

NO PUNCTURE. *Puncture path in Lapp Post design is as great as flashover path. Insulator will flash over rather than puncture.*

NO CRACKING. *One piece post body, not subject to bursting from tension strains created by thermal changes in nested parts.*

RADIO INTERFERENCE. *By virtue of design factors alone, radio interference is permanently prevented at rated neutral voltage.*

NO CLEANING. *Fog-type design preserves uniform leakage path, prevents leakage flashover, makes the unit "self-cleaning."*

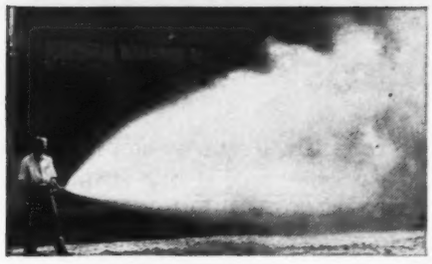
MECHANICAL RUGGEDNESS. *Stones or bullets deflect off, or rupture petticoats, leaving post body intact and insulator secure.*

Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.

Navy Fire Fighters use WaterFOG

WaterFOG is one of the new devices used by the Navy in its training schools for fire fighters. High velocity WaterFOG discharged from an SG-40 WaterFOG nozzle shielded these Navy Fire Fighters and quickly extinguished this raging oil fire.



High velocity WaterFOG from an approved SG-40 nozzle designed for the U. S. Navy by Rockwood Sprinkler Company.

★ ★ ★

Hundreds of industrial plants also have WaterFOG equipment,—both fixed piping installations and nozzles for hose lines.

What is WaterFOG?

WaterFOG is man-made fog, created by impinging streams of water from specially-designed Rockwood nozzles. It is particularly effective on oil fires, because of its great heat-absorbing area (much greater than in solid stream or spray) and its floating action.

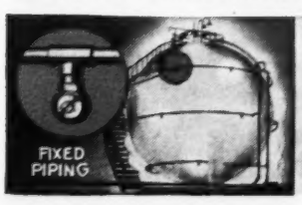
Instead of plunging quickly through the flame into the liquid, thus increasing vaporization — WaterFOG drifts gently into the combustion area, cooling both the burning vapors and the liquid surface, and then changing into steam, cuts off oxygen supply.

Many firms have given up more expensive, less certain fire-fighting methods to return to water. WaterFOG, economical, plentiful, prevents "flash-back", saves costly chemicals, lessens water damage and is a non-conductor. Rockwood installations are approved by Underwriters' Laboratories and Factory Mutuals. Write for bulletin 123.

ROCKWOOD SPRINKLER COMPANY
62 Harlow Street, Worcester 5, Mass.
Specialists in Fire Protection Engineering, Equipment and Installation since 1907

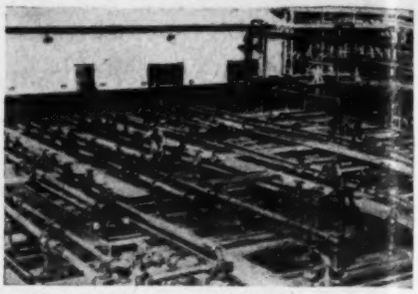
ROCKWOOD WaterFOG

Water Engineered by Rockwood Cools, Confines, Smothers Oil Fires



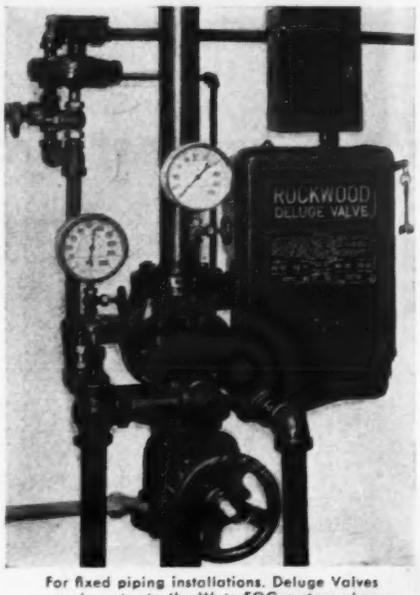
WaterFOG Installation Guards Refinery's Nerve Center

Vital and expensive equipment can be saved from the ravages of flammable liquid fires when a WaterFOG system of fixed piping is posted on guard.



For example, the manifold pits shown in the picture are protected by a WaterFOG system controlled by the Rockwood Dualguard Automatic Control.

Rockwood Dualguard Automatic Control



For fixed piping installations. Deluge Valves supply water to the WaterFOG system when automatic equipment detects fire.

Complete fire-protection effectiveness of a WaterFOG system depends upon proper engineering. Such factors as proper spacing of heads, distance between heads and hazards, etc. are important in determining correct particle size, fog pattern and velocity.

For this reason fixed piping installations should be engineered and installed by Rockwood engineers, who are authorities on hydraulics as applied to fire protection.

Typical WaterFOG Applications

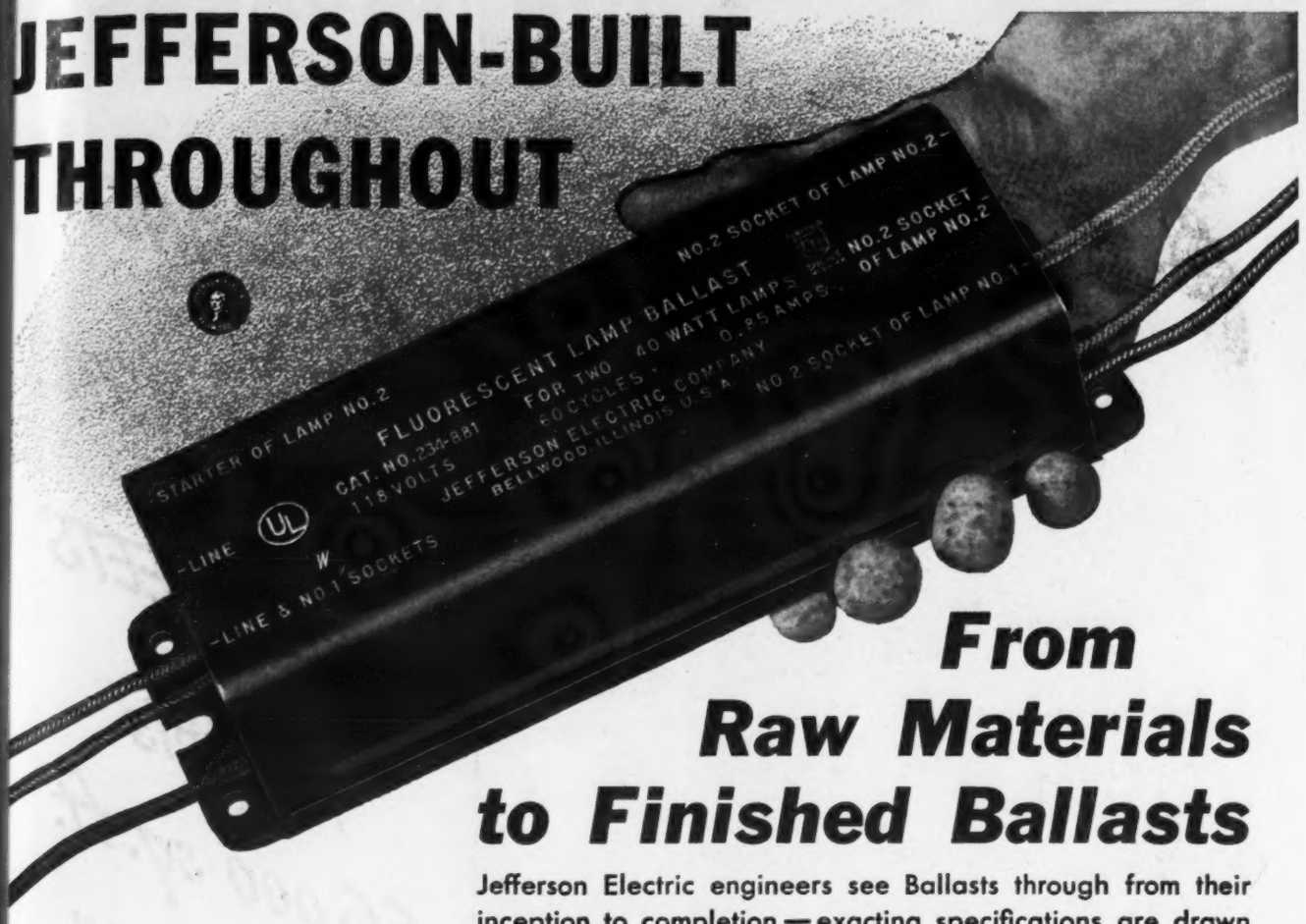
- transformers
- oil switches
- generators
- paint shops
- oil storage

etc.

COLORED MOVIE! Executives of firms having flammable liquid hazards are invited to write for a colored movie (16 mm.) showing tests of Rockwood WaterFOG.

Rockwood Sprinkler Company, Worcester 5, Massachusetts.

JEFFERSON-BUILT THROUGHOUT


FLUORESCENT LAMP BALLAST
FOR TWO 40 WATT LAMPS
60 CYCLES 0.85 AMPS
CAT. NO. 234-881
118 VOLTS
JEFFERSON ELECTRIC COMPANY
BELLWOOD, ILLINOIS U.S.A.
STARTER OF LAMP NO. 2
LINE
LINE & NO. 1 SOCKETS
NO. 2 SOCKET OF LAMP NO. 2
NO. 2 SOCKET OF LAMP NO. 2
NO. 2 SOCKET OF LAMP NO. 1

From Raw Materials to Finished Ballasts

Jefferson Electric engineers see Ballasts through from their inception to completion,—exacting specifications are drawn up for all raw materials used, inspection and test of samples follows their receipt—manufacturing processes are under control all along the line to insure uniformity of quality on large production basis.

Every Jefferson Electric Ballast you get has been made complete from raw material to finished product in our own plant. Improvements are really a continuous occurrence—no outside source to cause delays. Any betterment in design, material, or process can be put into effect immediately,—another reason why Jefferson Electric Ballasts are given highest rank by experienced fluorescent lamp manufacturers, engineers and contractors.

New Bulletin 441-FL contains the latest complete data. Write for a copy . . . JEFFERSON ELECTRIC COMPANY, Bellwood, (Suburb of Chicago) Illinois. *In Canada:* Canadian Jefferson Electric Co. Ltd., 384 Pape Avenue, Toronto, Ont.

BALLASTS with BOTTOM LEADS

• The complete line of Ballasts includes types with the leads extending at the bottom through bushed holes. Their use saves material and time since they may be mounted on narrow wiring channels above the fixture. They are available in the popular capacities: two- and three-lamp, 40 watt; —two- and four-lamp, 100 watt. For complete data refer to pages 3 and 6 of new Bulletin 441-FL.

JEFFERSON ELECTRIC

BALLASTS

ANACONDA MUNTZ METAL TUBE SHEETS for this 65,000 sq. ft. Condenser

A 65,000 sq. ft. public utility surface condenser under construction in the plant of C. H. Wheeler Manufacturing Company at Philadelphia. The tube sheets, 264″ x 234″, were assembled from Anaconda Muntz Metal plates, 1½″ thick.

Anaconda Tube Sheets in a number of alloys are supplied in circles, half circles, segments, rectangles and squares, as well as in special shapes such as those supplied for this condenser. These plates are accurately alloyed, commercially flat, readily machinable and true to dimension.

Should you desire assistance in the solution of condenser or heat exchanger problems, the Technical Department of The American Brass Company is at your service. For complete information on alloys and methods of manufacture, send for Publication B-2, "Anaconda Tubes and Plates for Condensers and Heat Exchangers." 44190

ANACONDA

Anaconda Copper & Brass

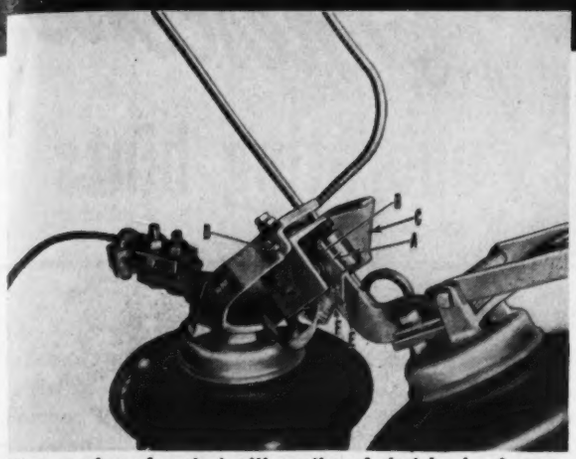
THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company—In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

THREE E "8900-U" TYPE

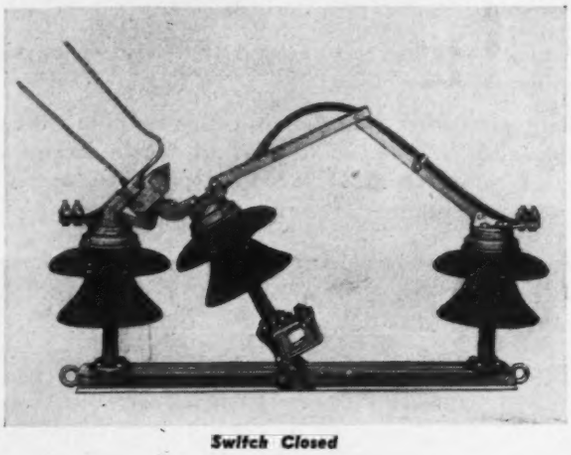
Simplicity

THE PRIME REQUISITE OF A GOOD AIR BREAK SWITCH

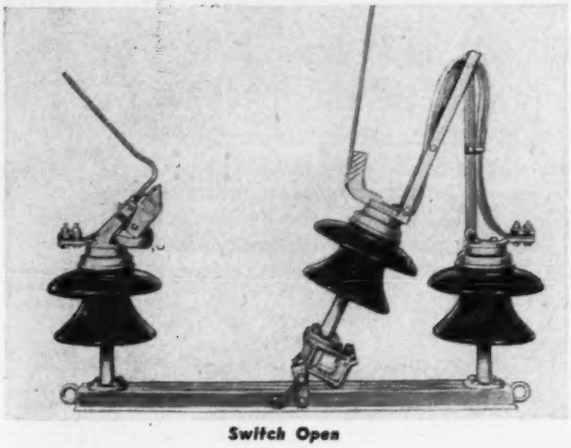


Close-up view of contact with portion of sleet hood cut away

● Copper shoes "A" float on Monel Metal Springs "B" inside of Sleet Hood "C". The entire assembly is pivoted on pin "D". Contact surfaces "E" on blade wipe contact shoes clean with each closing operation and force dirt or foreign matter off the contacts through grooves "F".



Switch Closed



Switch Open

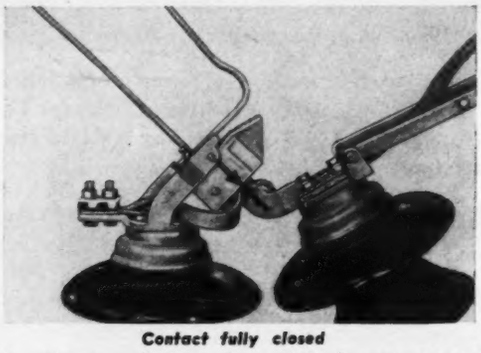
● The most indispensable requirement of a good air break switch is that it be simple and of the fewest possible parts. Such a switch is the "8900-U" type.

The operation of the "8900-U" type air break switch is accomplished by tilting one insulator of each pole, forward to close, backward to open. Its contacts are the full floating, self-aligning, pivoted type—simple, rugged, and effective. There are no close adjustments to be maintained in any of the switches' working parts, consequently the operation of the "8900-U" type switch is smooth, easy, and positive under all conditions.

Its design incorporates all the experience and knowledge gained in twenty years of manufacturing tilting insulator type air break switches.

Made in ratings up to 34.5 K. V. and 600 ampere.

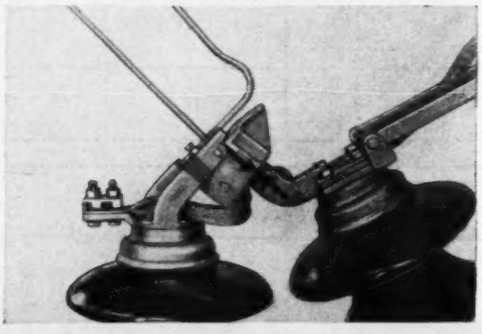
Bulletin #322 gives detailed information. Ask for it.



Contact fully closed

● Position of arrows illustrate how pivoted contact assembly is moved slightly when blade starts to disengage shoes. The resultant shearing action between the contact shoes and blade breaks any seal caused by sleet or corrosion, and enables switch to open easily.

Contact starting to open



THREE E ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK ILLINOIS

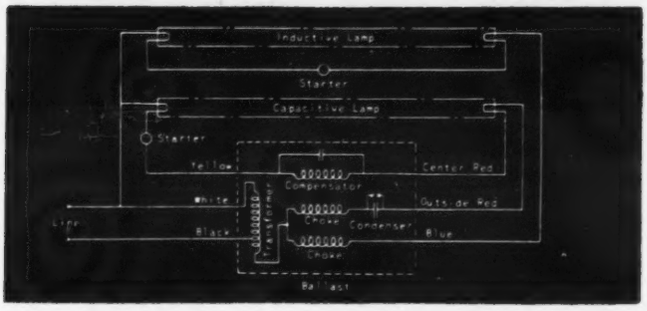
No. 4 in a series published by SYLVANIA for all users of fluorescent lighting

Fluorescent operating hints

BALLASTS

The ballast is a current-limiting device essential to the operation of fluorescent lamps. Without a ballast, the current would rise instantly to a value that would destroy the fluorescent lamp, which is an electrical arc-discharge source.

The ballast consists of an iron-core choke coil and condenser elements embedded in insulating compound. Only the wires necessary for connections with the external circuit are visible. The diagram below shows the internal elements of a ballast and the hook-up in a typical two-lamp circuit.



Ballasts also provide for power-factor correction. A high power factor is essential to lighting efficiency. The table below shows the wattage consumed by both the single and two-lamp types of ballasts.

BALLASTS FOR FLUORESCENT LAMPS

Lamp Size	Line Volts	Approximate Wattage Loss	
		Single Lamp Type	Two-Lamp* Type
6	110-125	2	—
8	110-125	2.8	—
15	110-125	4½	9
20	110-125	4½	9
30	110-125 199-216 220-250	10 9 9	14½ 12 12½
40	110-125 199-216 220-250	13 12 13	17½ 13¾ 14½
65	110-125	12	24
100	110-125 199-216 220-250	24 24 24	35 35 35

*Wattage loss is for both lamps.

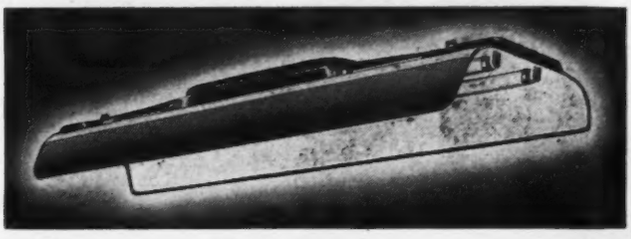
BALLAST SERVICING

Properly designed and installed ballasts last indefinitely under favorable conditions. That is why the ballast is the last thing to check when lamps fail to light. When you are sure that starter and lamp are not at fault, test the ballast by hooking up a bell ringer in series with the coils. If bell fails to ring, you know that ballast is defective.

Don't Try to Repair a Bad Ballast. Replace it with a new one. Then there will be no risk to your investment in fluorescent equipment.

A hum that grows in severity is a sure sign of impending ballast trouble.

Improper ballast equipment can cause lamps to blink with a definite "on" and "off" period and thereby shorten lamp life. Be sure to use the right ballast replacement, as specified by the manufacturer of your particular fixtures.



THE BALLASTS ARE RIGHT IN SYLVANIA "PACKAGES OF LIGHT"

Sylvania sells industrial and commercial fixtures complete with lamps, ballasts, sockets, starters — wired and ready for immediate installation. The ballasts in every Sylvania fixture are made to the same high quality standards as Sylvania lamps, starters, reflectors and sockets.

For Additional Maintenance Information
Send For This Free Booklet

SYLVANIA ELECTRIC PRODUCTS INC.

"Fluorescent at its Finest"

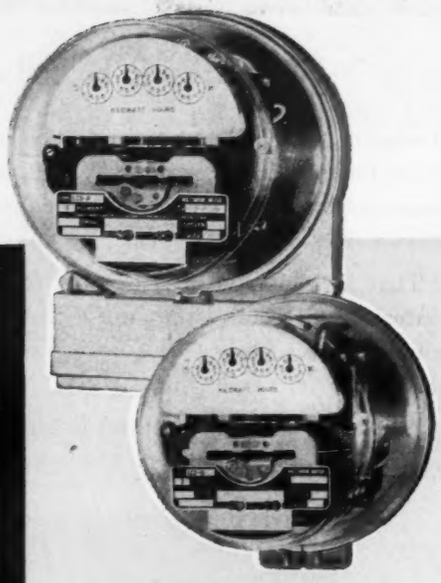
SALEM, MASSACHUSETTS

FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, INCANDESCENT LAMPS, RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES

WAR BONDS MAKE UNCLE SAM MORE POWER-*full*

"On Measurement is founded the whole progress of man.."

A meteorologist in Uncle Sam's armed forces might well pause when he ponders the comparison between his modern scientific instruments and the original Galileo thermometer. The Galileo air-thermoscope consisted of a glass bulb containing air, connected to a glass tube of small bore dipping into a colored liquid. This contraption was affected by variations in atmospheric pressure as well as temperature changes, so our sixteenth century forefathers were never sure of the true temperature. Yet, this was the conception of accurate measurement. Compare it with today's high standard of measurement of electricity set and met by the electric utilities and the manufacturers of watthour meters.



NO OTHER COMMODITY IS MEASURED SO *Accurately* AS ELECTRIC POWER

● SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS ●

The Black Hand of Corrosion Can Come from the Skies!

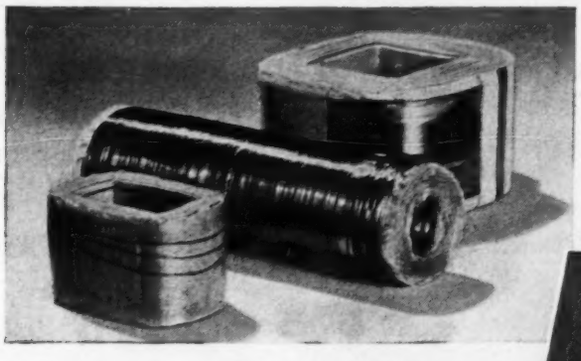
Humidity, which settles on and in electrical equipment, is the forerunner of corrosion that disrupts communications and impairs the operation of electrical instruments and services.

That is why it is so important to use an insulation material which is resistant to electro-chemical oxidation when in the presence of current-carrying copper wire and moisture.

Lumarith (cellulose acetate) is big in the news today because it is resistant to the corrosive influence of moisture. In foil, film, molded and other forms, it is the ideal insulator for coils, tubes, bobbins and other electrical parts.

The Celanese Celluloid Corporation's research department has prepared a booklet outlining the properties of Lumarith dielectrics. The information you will need—dielectric strength, resistivity, power factors, etc.—is readily available within its pages. Write for your copy. Celanese Celluloid Corporation, *The First Name in Plastics*, 180 Madison Avenue, New York City 16, a division of Celanese Corporation of America, sole producer of Lumarith and Celluloid plastics. *Representatives:* Dayton, Philadelphia, Cleveland, Chicago, St. Louis, Detroit, Los Angeles, Washington, D. C., Leominster, Montreal, Toronto.

*Reg. U. S. Pat. Off.



LUMARITH PLASTICS . . IN FILM . . FOIL . . MOLDING MATERIAL AND OTHER FORMS

Lumarith* **A CELANESE PLASTIC**

TUNE IN The Celanese* Hour—*"Great Moments in Music"**—Columbia Network, Wednesdays, 10 P. M., E. W. T.

Intelin Ultra High Frequency Transmission Line

Precision workmanship and intensive step-by-step inspection insure the perfection of Federal Crystals — now flowing in an endless stream to vital military applications.

When the war began there was no Ultra High Frequency Transmission Cable available to meet military needs for special radio applications.

Federal, with its unsurpassed research and production facilities, enlisted to fill the breach. Chemists and engineers, working day and night, developed the first dielectric that would fully meet the severe electrical and physical specifications of tough military requirements. Result: INTELIN Ultra High Frequency Coaxial Transmission Line . . . a major contribution to the science of radio communication.

Federal, from the beginning of its cable manufacturing activity, has made research and development the keystone for the establishment of Federal technical leadership in the high frequency cable field.

This outstanding technical ability has been applied to the solution of any and every cable problem submitted—and is now a focal point for the development of high frequency cables for the military and for industry.

Again Federal leads the way!

Federal Telephone and Radio Corporation

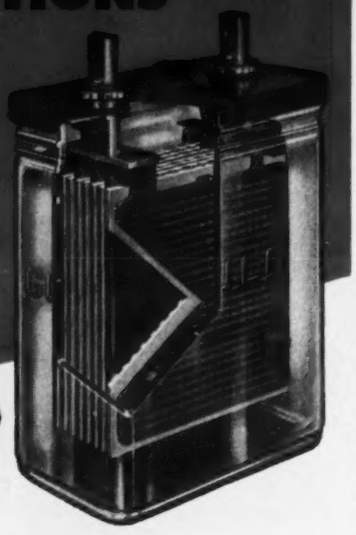
An IT&T Associate

Newark 1, N. J.

the GOULD plante
First choice for CONTROL and STANDBY OPERATIONS

PURE LEAD POSITIVES
DUAL SUSPENSION
LOW INTERNAL LOSS
LARGE AREA OF ACTIVE MATERIAL

HIGH CAPACITY



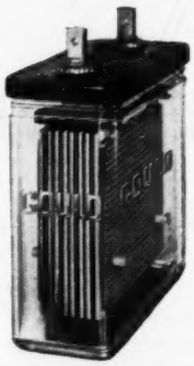
Call Gould TO SOLVE YOUR BATTERY PROBLEMS

HIGH DISCHARGE RATE
EXCEPTIONALLY LONG LIFE
REGENERATIVE QUALITY

Rated Conservatively . . . Goulds equal or exceed in capacity any battery of comparable size and cell structure.

★

Are you receiving the monthly, informative "Gould Battery News"? If not, write for it.



• The Gould Plante positive plate embodies many exclusive features that assure dependable, long life service. Made entirely of pure lead it is finely ribbed to increase surface area and give high capacity. Its positive active material, converted by electro-chemical action from the base plate, maintains conductivity by chemical rather than mechanical contact. The use of pure lead also eliminates internal stress due to dissimilar metals and provides new active material, and through it a long battery life, by the normal action of the battery in active service.

Add to this a negative plate of equal performance and Gould's Dual Suspension, which prevents distortion of the battery elements, and you have a battery that through years of actual service has been first choice for control and standby operations.

Get all the facts on the Gould Plante. Ask for the Gould Sealed-in-Glass Bulletin, using business letterhead.

GOULD STORAGE BATTERY CORP.
DEPEW, N. Y. • Factories at Atlanta • Chicago • Dallas • Depew Leavenworth • Los Angeles • North Bergen • Rock Island Sioux City • St. Paul • Zanesville

FOR EXCELLENCE IN STORAGE BATTERY PRODUCTION AT DEPEW PLANT

GOULD

Since 1898 THE BATTERY PICKED BY ENGINEERS

BATTERY VOLTAGE

One of a series of service suggestions for users of industrial batteries

▶ The voltage of a fully charged lead-acid storage battery in good condition is around 2.1 volts. This is true no matter how large or small the cell may be. Multiples of 2.1 volts therefore determine the voltage of your battery. If, for example, it happens to contain 15 cells, its open circuit fully charged voltage is 31.5 volts.

The voltage of a cell on discharge is influenced by many factors. Among these are: the cell's size, the state of charge at the beginning of discharge, the temperature of the battery and, above all, the original design and present condition.

The normal operating range for cells in cycling service is from 2.00 to 1.75 volts. However, at the very start of this discharge there is likely to be a slight drop in voltage that is shortly followed by a corresponding rise. This is due to the fact that the action is at first confined to the sulphuric acid contained in the pores of the plates.

Diffusion, or spreading, of the acid from the electrolyte to the plates is what keeps the battery discharging and the voltage delivered by each cell is directly affected by this concentration of acid in and around the pores of the plates. This operation is continuous but as more and more acid is "used up" in the discharge operation the solution becomes weaker. There is a gradual decrease in voltage until the concentration of acid in the electrolyte is too weak to supply the needs of the plates. As a result the cell voltage drops below the operational point of around 1.75 volts, and the battery is considered discharged.

Temperature also affects the voltage characteristics of a lead-cell battery. In cold weather acid increases in viscosity and thus the speed of chemical reaction is proportional to the temperature. This affects the ampere hour capacity and, therefore, a battery operating in a cold climate will not have the same operating hours as one working under more temperate conditions.

(Advertisement)

"On Location"

FOR NEW POSTWAR LOADS... IN ONE UNIT!

Quick, low-cost reconversion . . . with Westinghouse CSP Distribution Transformers

Going "on location" to new postwar load centers is greatly simplified with Westinghouse CSP (Completely Self Protecting) Distribution Transformers. There is no time-consuming, costly disassembly and reassembly of nine or so pieces of conventional equipment.

Every part of the CSP transformer is built-in. To move it, all that needs to be done is: disconnect . . . take to new location . . . mount . . . reconnect. Tomorrow's unpredictable loads can be handled with minimum investment in time and money.

Many CSP transformers can be moved in the time ordinarily required for a few conventional installations.

Westinghouse CSP Distribution Transformers offer maximum *load adaptability* for better service continuity. A signal light warns of an overload before the internal breaker trips. *All* the thermal overload capacity is made *safely* available for short-time overloads.

For complete information, call your Westinghouse office or write for DD-46-100, Westinghouse Electric & Manufacturing Company, Dept. 7-N, East Pittsburgh, Pa. J-70428

WESTINGHOUSE CSP DISTRIBUTION TRANSFORMERS CONTAIN:

- transformer
- "De-ion" arrester
- circuit breaker for overload and short circuit protection
- grounding gap
- current limiting resistor

WESTINGHOUSE

Westinghouse

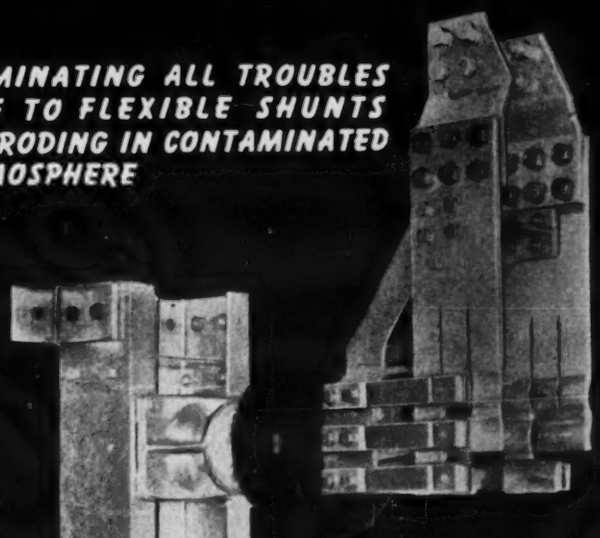
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

PACKAGED POWER

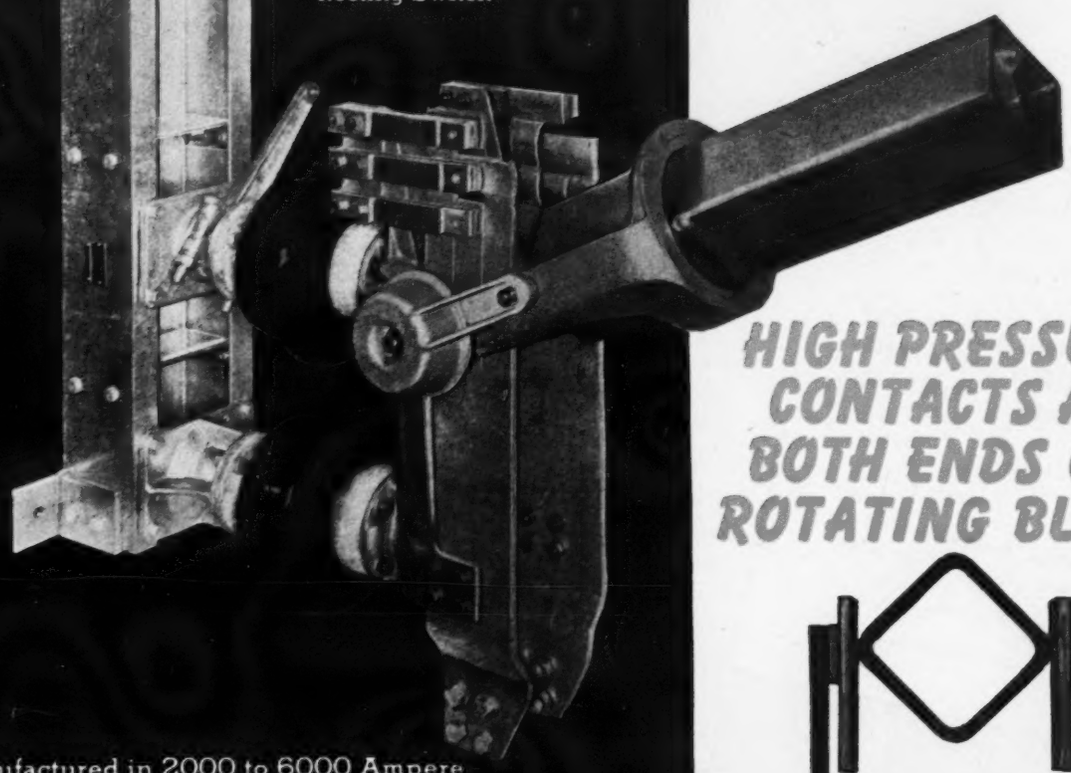
NO BRAIDS*

ON THESE "MK-39" SWITCHES

*ELIMINATING ALL TROUBLES DUE TO FLEXIBLE SHUNTS CORRODING IN CONTAMINATED ATMOSPHERE



Single-Pole Unit of 23 Kv., 4000 Amp. 3-Pole Disconnecting Switch



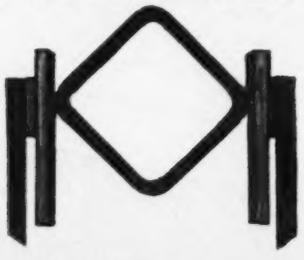
Manufactured in 2000 to 6000 Ampere Ratings -- 7.5 to 34.5 Kv. Inclusive

ALSO CONSIDER THESE FEATURES

1 High-Pressure Silver-to-Copper Contacts
2 Straight Line Current Path
3 Completely Counterbalanced Blade—Insuring Ease of Group Operation
4 Rugged Construction—Ample Inherent Electrical and Mechanical Safety Factors
5 Upright, Vertical or Inverted Mounting

WRITE FOR PUBLICATION 4209

HIGH PRESSURE CONTACTS AT BOTH ENDS OF ROTATING BLADE



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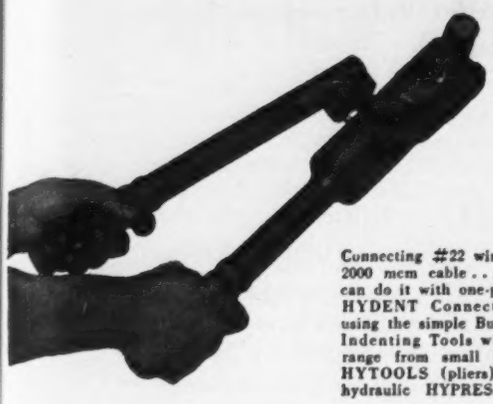
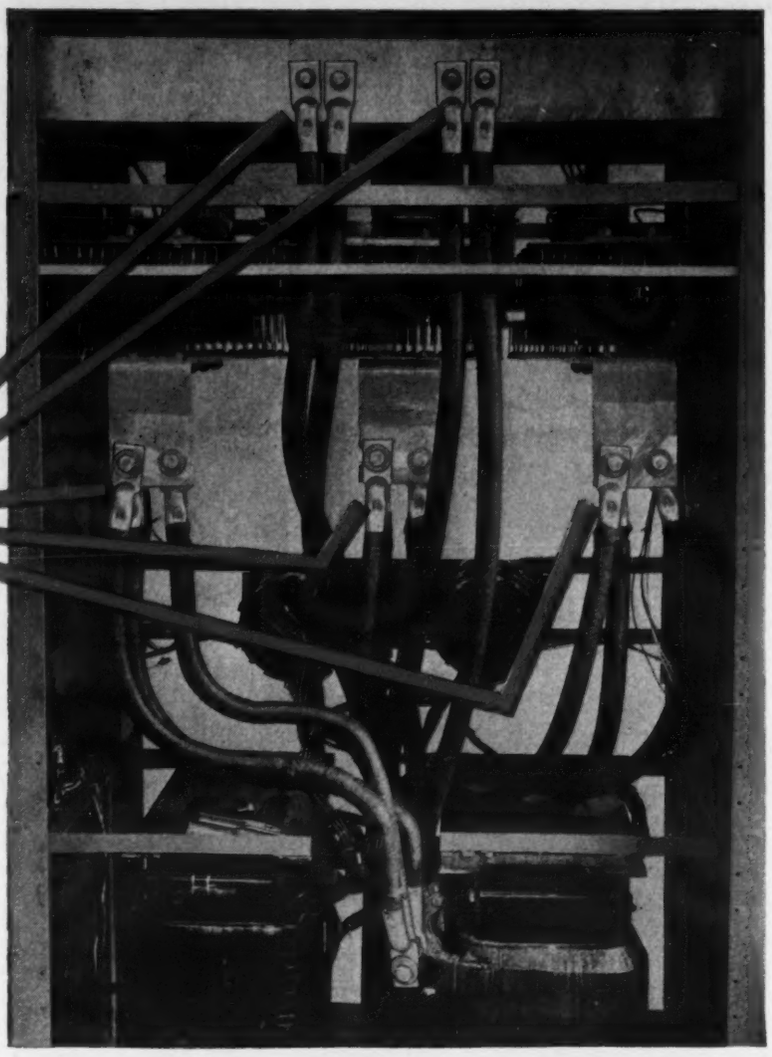
Hydent
CONNECTORS



Connecting #22 wire or 2000 mcm cable . . . you can do it with one-piece HYDENT Connectors, using the simple Burndy Indenting Tools which range from small hand HYTOOLS (pliers), to hydraulic HYPRESSES.



The Modern Way

. . . to make permanent electrical connections *permanent!*

On circuits everywhere, you now see modern Burndy HYDENT (Indent Type) connections like those above . . . in place of old-fashioned connections made by methods which were time-consuming and uncertain.

The Indent connection has been widely adopted because the indenting principle removes all uncertainty over the strength and permanency of the connection. Further, the HYDENT connectors used are of *one-piece, pure copper* construction . . . assuring highest electrical conductivity. And they are installed in a *fraction of the time* . . . another feature industry likes, too.

Pioneered and proved by utility engineers, the HYDENT connection has been a significant aid to our war effort . . . and will contribute materially to product and production efficiency in the days to come. Bulletin on HYDENT Connectors gladly sent on request.

BURNDY ENGINEERING CO., INC., 107 Bruckner Boulevard, New York 54, N. Y.
IN CANADA: Canadian Line Materials, Limited, Toronto 13

WHAT EVERY MANUFACTURER AND DESIGNER SHOULD KNOW ABOUT

PANELYTE* *the structural plastic*

Mass production of **Sheets, Rods, Tubes, Molded Forms, Fabricated Parts.**

For these Industries: **Automotive, Aviation, Central station, Chemical, Communications, Electrical Equipment, Maritime, Paper Mill, Petroleum, Radio, Refrigeration, Textile, Transportation.**

---

1 WHAT PANELYTE IS

PANELYTE is the trade name for a wide range of structural, laminated resinous plastics, produced in 32 grades, with paper, fabric, wood veneer, fibre glass, and asbestos bases.

2 WHERE PANELYTE IS USED

In the refrigerator, automotive, electrical and chemical industries, PANELYTE has long been one of the largest producers of molded and fabricated, electrical and structural plastic parts. Before the war, PANELYTE was also widely used in central station, communications, maritime, and paper mill equipment, as well as in the petroleum, radio, textile and transportation fields. Today the facilities of the greatly enlarged PANELYTE plant are enlisted in the war effort, serving principally the aviation industry and the various branches of the armed forces.

3 WHY PANELYTE MAY SOLVE YOUR PROBLEM

Originally thought of as an alternate for critical metals, designers and engineers have learned through experience that PANELYTE is instead a *unique* material *for which* there is *no* substitute. In addition to availability, PANELYTE reduces costs and assures greater efficiency and longer life.

4 PANELYTE ENGINEERS WILL WORK WITH YOU

Our engineering staff can quickly tell you whether or not PANELYTE is the material *best* suited to your needs. If a laminated structural plastic can improve your product, increase your production, save you money, simplify assembly, or aid the War effort *in any* way, the services of our seasoned engineers are at your immediate service. Data Sheets and samples are available.

PANELYTE *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

ARMY (E) NAVY

Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Montreal, New Orleans, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Toronto, Trenton, Vancouver

* MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS

15-KW OF HIGH-SPEED ELECTRONIC HEAT

WITH THE NEW RCA 15-B

IN nearly every case where electronic power has been applied for heating, important savings in time have resulted. The high-frequency power generated by the new RCA 15-B is suited to heating a wide variety of non-metallic substances because of the wide choice of frequencies it offers — from 2 million to 10 million cycles per second.

Why Electronic Heating? When high-frequency electricity is applied to non-metallic materials, it heats them — *all the way through.* For example, a block of wood can be heated uniformly by high-frequency power while with ordinary heating methods, the heat would have to "seep" in from the outside.

The uniformity of electronic heating makes it possible to introduce heat at a high rate. Processes that once took hours can now be completed in minutes.

The uniform heating often means better uniformity in the finished product, and little or no internal stresses to cause warping.

What Materials Can Be Heated? Wood, plastics, paper, glass, rubber, foods, chemicals, tobacco, ceramics—and many other industrial materials can be heated electronically.

How Much Heat Will the 15-B Give? The new RCA 15-B electronic generator is rated at 15 kilowatts output. It will deliver up to about 50,000 B.T.U. per hour, depending on the load conditions.

Easy to Operate. The 15-B is push-button controlled. Once the correct processing procedure is established, any intelligent operator can use it with ease. RCA field engineers are available to help with your application problems.

Get the Full Story. A comprehensive 12-page descriptive catalog on the RCA 15-B generator is yours for the asking. Use the convenient coupon below. If you have a specific application for electronic heat in mind, write, stating particulars, to RCA, Electronic Apparatus Section, Camden, New Jersey.

RCA

RCA ELECTRONIC HEAT

RADIO CORPORATION OF AMERICA

FREE

BUY WAR BONDS

RCA, Electronic Apparatus Section, Camden, N. J.

Please send me details on the new RCA 15-B electronic generator.

Name.....

Company.....

Address.....

City.....State.....

70-44F

15 HENDY FEATURES

In the turbine—

1. Economical water rate per kwh.
2. Rigid spindles with discs having large hub sections form the backbone of the turbine structure and assure greater strength.
3. Step cut labyrinth diaphragm seals.
4. Steel Rateau nozzle discs with welded-in, rolled stainless steel nozzle blades and spacers.
5. Governing system that uses anti-friction bearings and is without stuffing boxes or soft packing.
6. Smooth, compact design without sacrifice of accessibility.

In the reduction gear—

7. Fabricated steel gear case, smoothly finished — no sharp corners or edges.
8. Rigidity combined with light weight.
9. External piping reduced to a minimum.

In the generator—

10. Rolled steel-plate field yoke of split type with halves bolted together.
11. Shock-proof, solid construction, giving greatest safety under adverse conditions.
12. Liberally dimensioned, providing capacity for emergency overloads.
13. High efficiency through careful design.
14. Self-aligning sleeve type bearing mounted in spherical seat insuring simple alignment of shaft.
15. Sixty-six years of generator building experience.

New.. POWER for a more electrified America

Built to the rigid requirements of U.S. Navy and Maritime Commission specifications for war service today, this Hendy Turbo-generator plant forecasts the standards for postwar electric generating equipment.

In developing its rugged, compact design, Hendy engineers swept the boards of old ideas—the result is a unit of sound reliability and long service life.

Construction features normally found only in larger turbo-generators are in these new Hendy power plants. These features insure larger factors of strength and safety, more economical operation and higher over-all efficiency.

Hendy turbo-generating plants are designed in a range of 250 to 750 kw permitting their use in a wide variety of marine and industrial service. Submission of your specification requirements is invited.

JOSHUA HENDY Division
JOSHUA HENDY IRON WORKS

SUNNYVALE, CALIFORNIA

EST. 1840 HENDY

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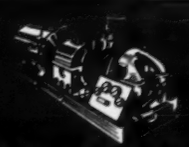
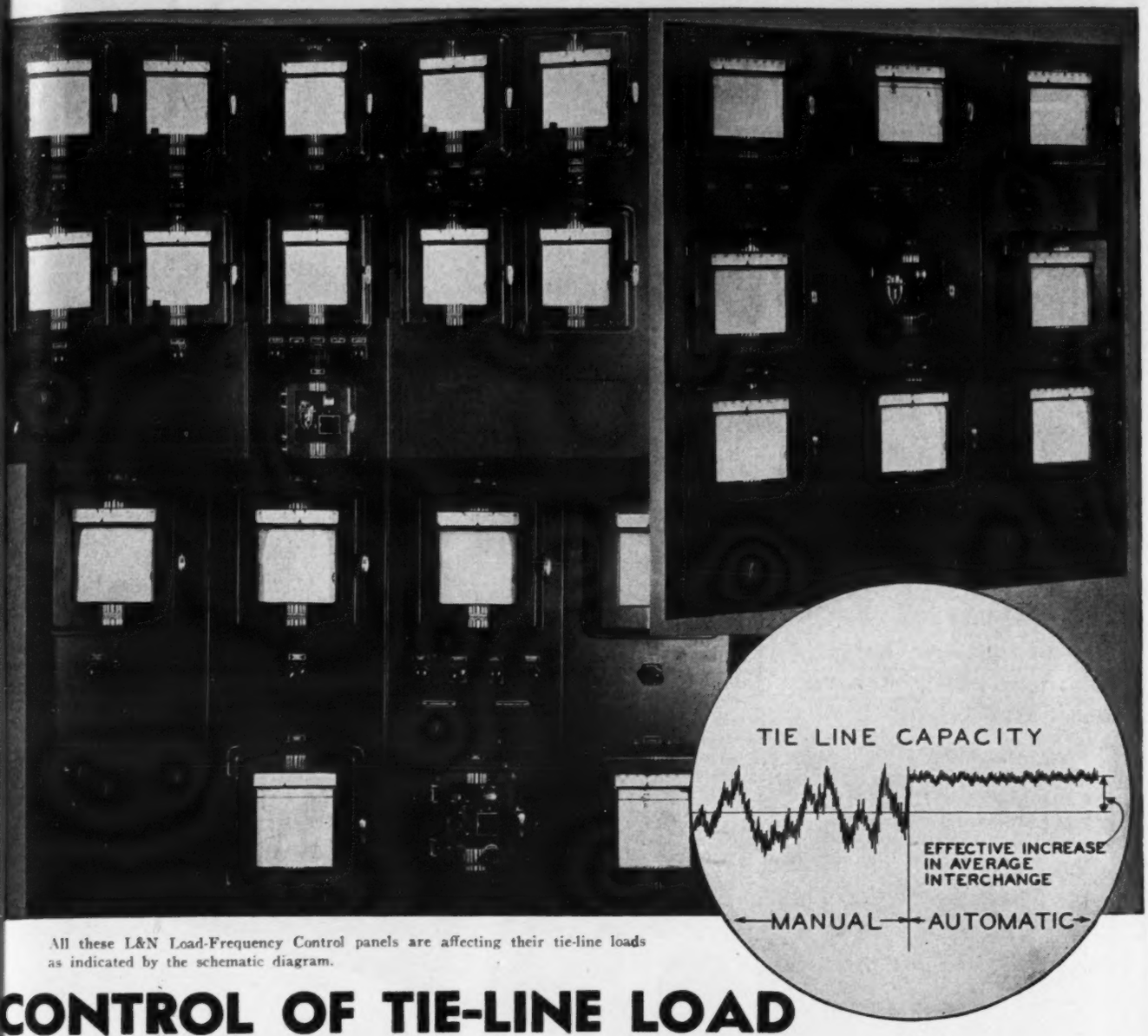


TURBO-GENERATORS

REDUCTION GEARS

STEAM TURBINES

DIESEL ENGINES



All these L&N Load-Frequency Control panels are affecting their tie-line loads as indicated by the schematic diagram.

CONTROL OF TIE-LINE LOAD IS LIKE "FINDING" A GENERATOR

The effective carrying capacity of a tie-line is increased, instantly and permanently, when the switches are thrown to turn load-frequency regulation over to the appropriate battery of L&N instruments.

There's no mystery about how the result is achieved; it's simply because all significant facts concerning interchanges and outputs are telemetered to the system-regulating point or points, where the fully-automatic instruments are fast, sensitive and accurate enough to execute the dispatchers' wishes more closely than men could execute them. The average of tie-line load rises toward the line's capacity; the line carries more load; the effect is the same as though another generator has been found and put to work.

And this is not only in isolated cases; it is being attained in war-busy power centers all over the country. We show above just a few of the panels we have recently supplied for this service; each designed after conference with the operating engineers concerned; each built to help that one network carry its load more effectively.

For a description of the equipments, see Technical Publication N-56-161 (1). For data on a specific problem, please write outlining the situation.

Jrl Ad N-56-161(4)

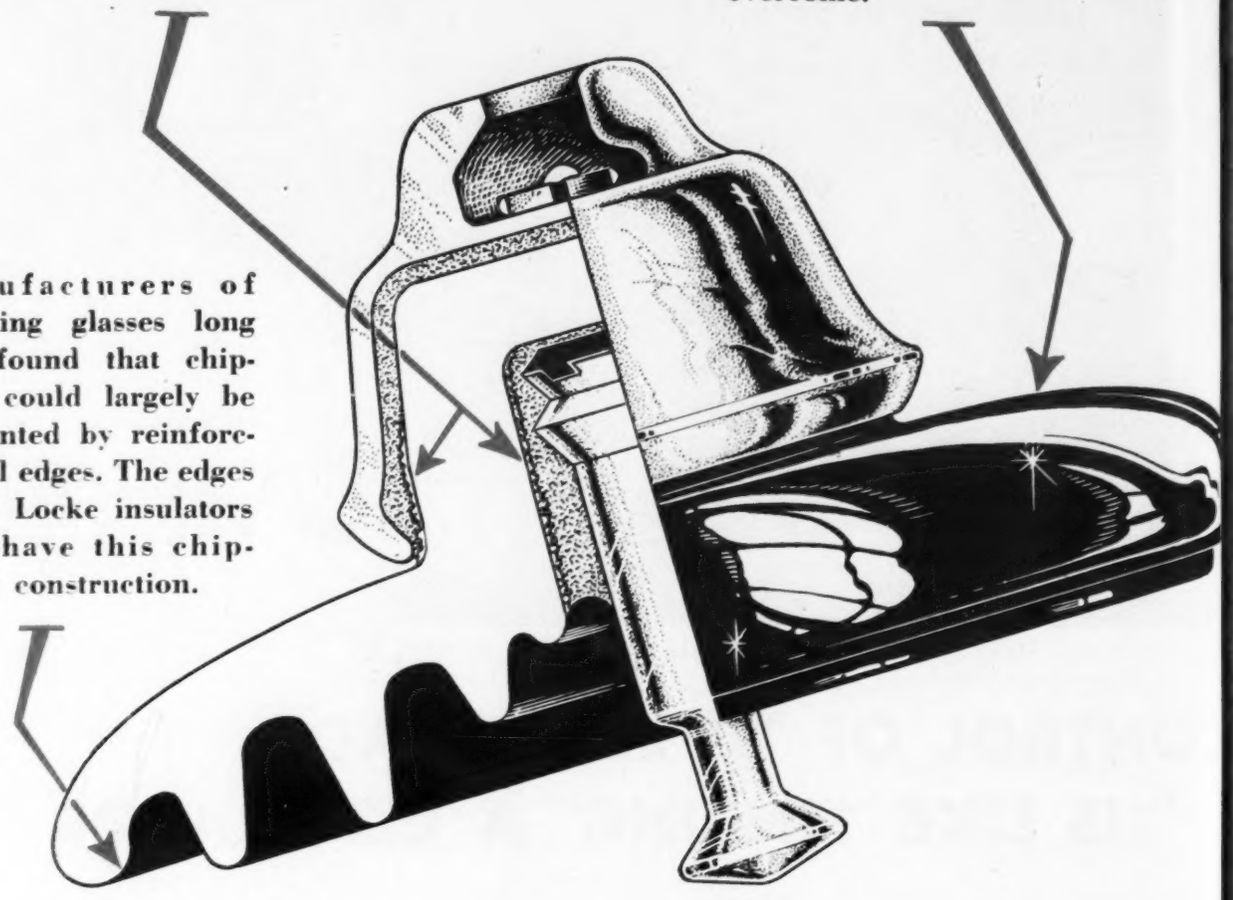
depends on me!
A Slogan For Every American

LEEDS & NORTHRUP COMPANY, 4936 STENTON AVE., PHILA., PA.
LEEDS & NORTHRUP
MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

How

Even compression glazed insulators can be materially weakened when these surfaces are treated with ordinary "sands". Locke compression sand, on the contrary, makes these working zones the strongest part of the assembly.

The entire surface of every Locke insulator is in compression. Before the initial crack which causes breakage can occur the additional compression strength must be overcome.



Manufacturers of drinking glasses long ago found that chipping could largely be prevented by reinforcing all edges. The edges of all Locke insulators also have this chipproof construction.

These Proved Benefits . . .

reduce upkeep—spread the initial costs of your insulators over more years—and enable your construction crews to handle installation and replacements faster and with greater safety.

ORIGINATOR AND LARGEST MANUFACTURER OF WET-PROCESS PORCELAIN INSULATORS

LOCKE INSULATOR

FIRST IN CLAYRAMICS

To Cut Your Line Construction Costs

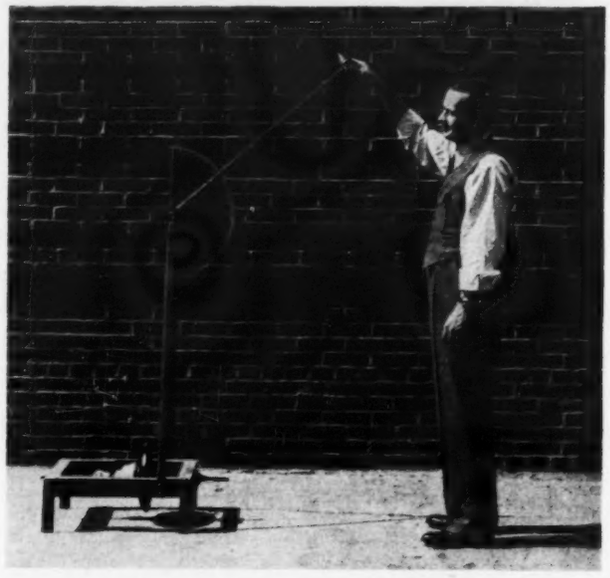
Labor, which is a large factor in construction costs, is reduced when construction material is easy to handle. That is why so many engineers and construction superintendents like Locke Insulators.

They are tough—with a whale of a lot of added resistance to breakage at all critical points.

Take a look at the husky sections of any Locke Insulator—made even stronger by Locke compression glaze—and compare them with the skimpy, fragile sections you so often see. Look at that heavy reinforced edge—extra toughness right where it is needed most.

Or rig up a simple impact test and try them out for yourself.

Then you'll know why Locke Insulators go up faster with less breakage during construction and stay up with a lower replacement rate.



90 INCH POUNDS

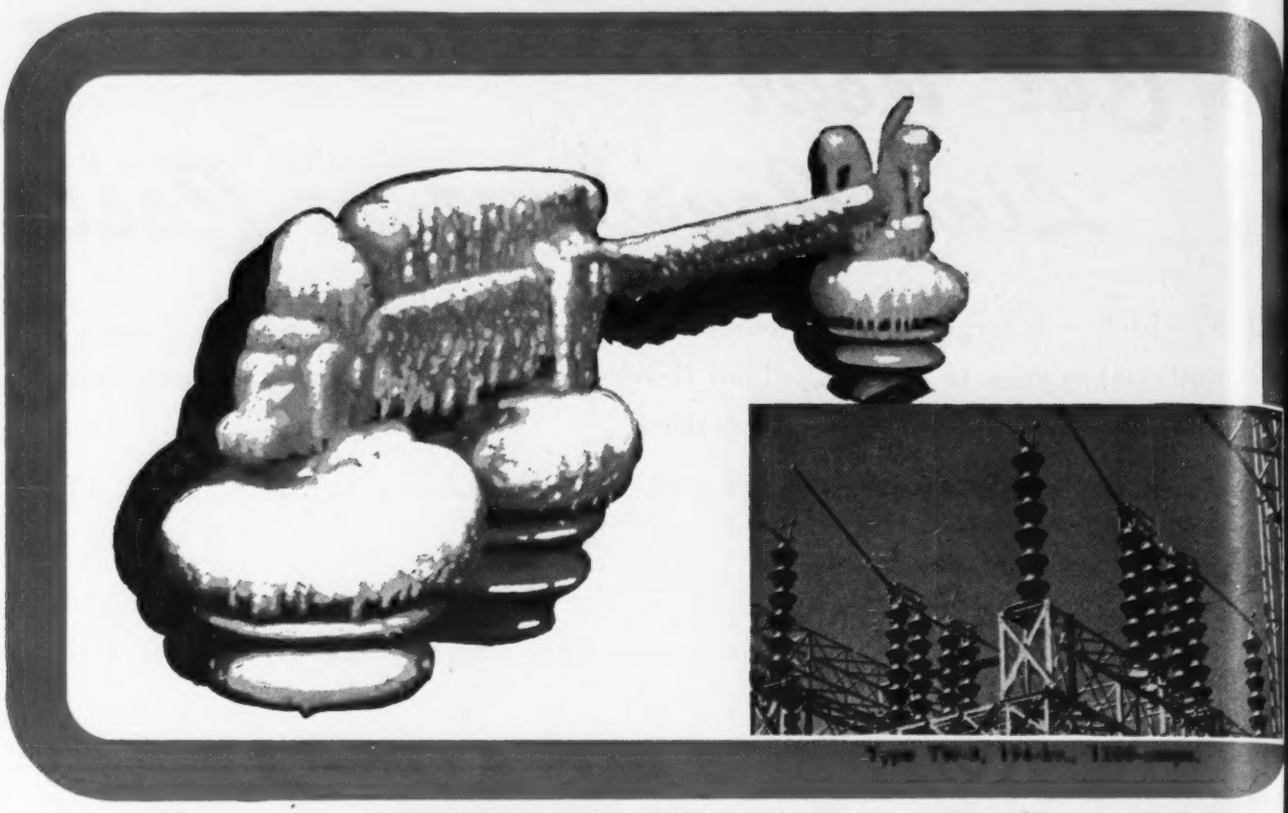
Locke rugged type suspension insulators—probably the most widely used suspension insulators in the world—will safely withstand impacts up to 90 inch pounds.

√ LONGER LIFE IN SERVICE
√ MORE UNIFORM STRENGTH
√ LOWER MAINTENANCE AND REPLACEMENT COSTS
√ HIGH FACTORS OF SAFETY
√ GREATER STABILITY

TY PROGRESSIVE YEARS OF SERVICE TO THE ELECTRICAL INDUSTRY

R CORPORATION BALTIMORE MARYLAND

FIRST IN CLAYRAMICS



..when FROZEN STIFF..

OPERATION IS STILL EASY

This PACIFIC ELECTRIC Switch-Blade Rotates, Cracks Ice, Then Opens . . .

For simple and easy operation under ice conditions—operating men like this Pacific Electric Switch.

Just move the operating handle. That first *turns* the blade, splitting the ice at both the contact and hinge. Then the switch blade starts moving in its vertical arc—simply and easily without use of gadgets.

If the switch is frozen in the open position, its chisel-like blade cuts into and knocks off the ice.

Here is summer reliability in switch operation when sleet pulls wires down.

For further assurance of easy operation in all seasons, the switch is counter-balanced. It has high-pressure contacts with silver inserts for cool operation while carrying full load.

Yes, it's made for utilities that want the most reliability for long years with the least upkeep, this switch designed by the Pacific Electric Mfg. Corporation, for 38 years specialists in producing high-voltage switching equipment.

Ask for full details about these switches which break through ice and operate easily because the blade rotates before moving in its vertical arc.

C. H. Cutter
1015 Securities Bldg.
Seattle, 1, Wash.

G. B. Kirkwood
437 S. Hill St.
Los Angeles, 13, Calif.

Filbert & Fredericks
90 West St.
New York, 6, N. Y.

J. E. Redmond Co.
448 W. Madison St.
Phoenix, Ariz.

A. A. Marrs
526 Dwight Bldg.
Kansas City, 6, Mo.

R. Ackerman
318 Dooly Block
Salk Lake City, 1, Utah

Other Representatives in Principal Cities

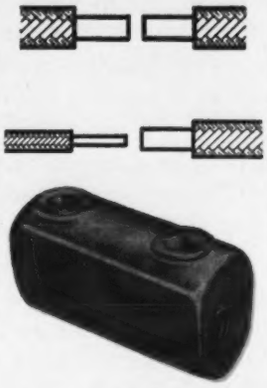
Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO, 24, CALIF. DUNES HIGHWAY, GARY, INDIAN

T&B Quick Guide FOR MAINTENANCE, REPAIR & CONSTRUCTION WIRING JOBS

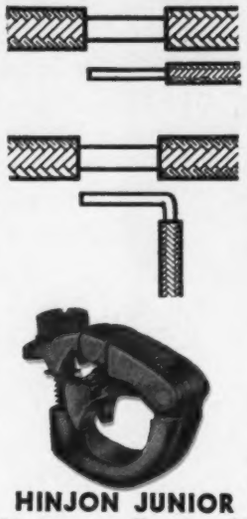
oking them up the T&B Pressure (Solderless) Way

LOCK-TITE LUG
7 sizes take *all* cables
#4 to 1,000,000 CM

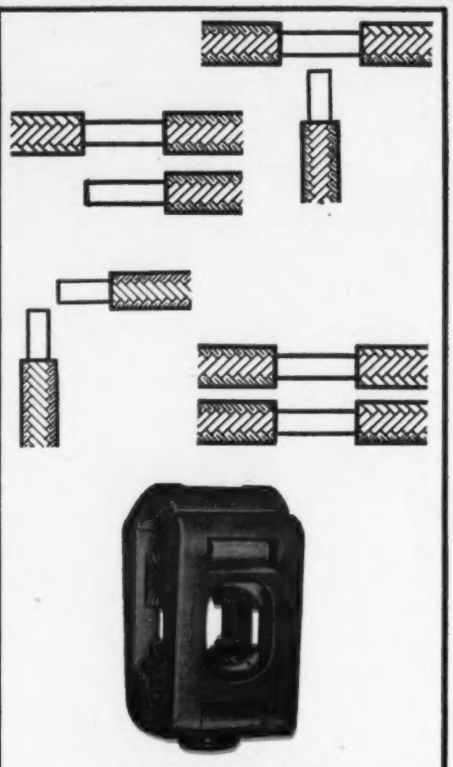


LOCK-TITE 2-WAY
7 sizes make *all* splices
#4 to 1,000,000 CM

Approved by
derwriters' Laboratories



HINJON JUNIOR
12 sizes tap *all* mains #8 to 1,000,000 CM to all branches #14 to #1.
Solid or stranded



LOCK-TITE TAP
6 sizes tap *all* mains 1/0 to 500,000 CM to all branches #2 to 500,000 CM

e Lock-Tite Way to button up wiring is mplicity itself.

glance at the guide pictures your indi-dual wiring requirements and identifies the correct Lock-te Connector for the job.

ch one of these standardized T&B fittings is so flexible t it takes a wide range of overlapping cable sizes, and ereby saves your store-room from stocking a miscellaneous ortment of seldom used pieces.

Lock-Tite Connectors are one piece construction with no se parts. A positive locking disc assures reliable perform-ce under continuous severe vibration. Being solderless, they a perfect cinch to install with key wrench or screw driver. lly salvageable.

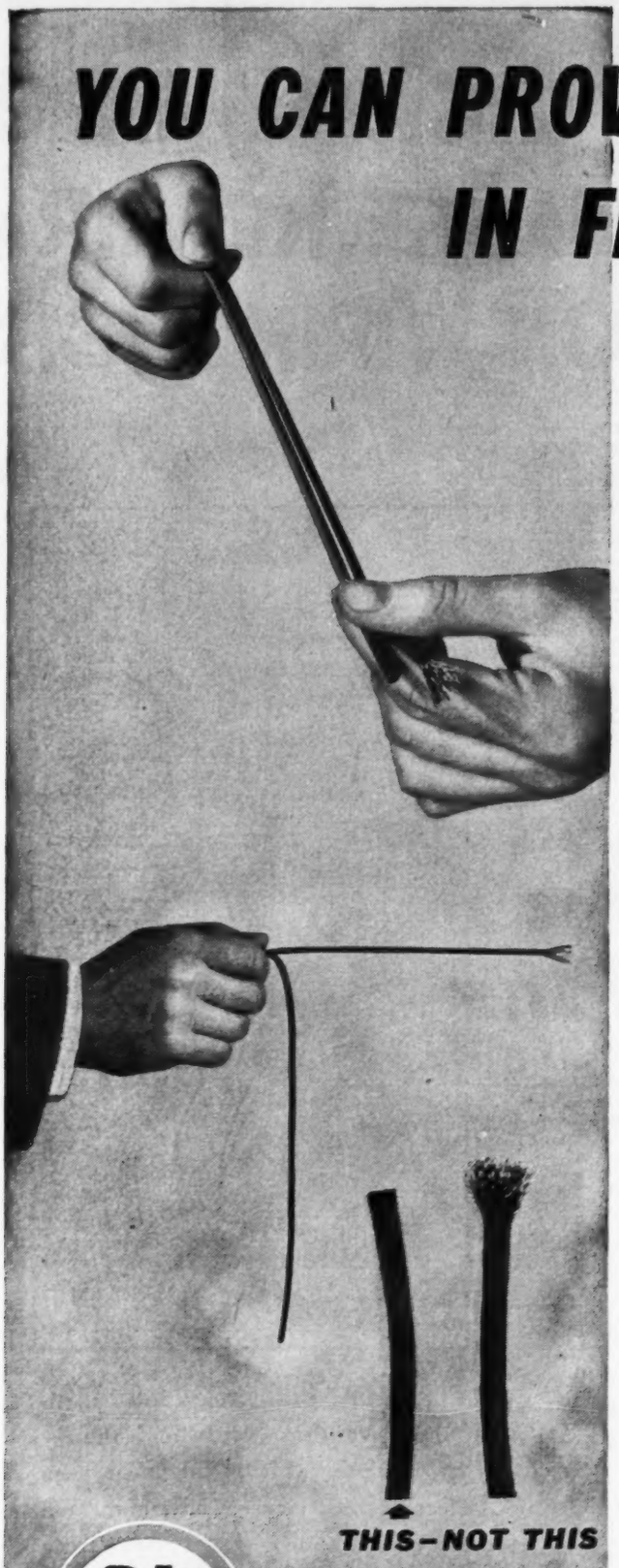
ey are engineered to take solid, stranded, flexible, extra xible, hemp-core, rod or tubing.

The Public Utility, as a local institution, can save time and money by dealing with a neighbor, the nearby Electrical Wholesaler. We distribute all T&B products through him exclusively.

Write for complete Lock-Tite Bulletin.

THE THOMAS & BETTS CO.
INCORPORATED
manufacturers of electrical fittings since 1899
ELIZABETH, N. J. NEW JERSEY
In Canada: Thomas & Betts Ltd. Montreal

YOU CAN PROVE TO YOURSELF IN FIVE SECONDS...



THIS—NOT THIS

That new BH Fiberglas "extra Flex" Sleeving is more flexible than saturated sleeving

WE'VE TOLD YOU about the non-fraying quality of the new BH Sleeving. But don't forget the extra flexibility we've built into it. You can prove this to yourself with the five-second test of sleeving flexibility:

Obtain from us a sample of BH Extra Flexible Fiberglas Sleeving equal in size to the saturated sleeving you use now.

Following Figure 1, hold eight-inch lengths of both BH Extra Flexible Fiberglas Sleeving and saturated sleeving between the thumbs and fingers of both hands. Stretch both sleevings to make them straight.

Now release the sleeving ends held in your left hand. Instantly, the new BH Fiberglas Sleeving will fall limp, proving its extra flexibility. The saturated sleeving will remain straight, practically inflexible. The comparison is shown in Figure 2.

NON-FRAYING • FLEXIBLE • HEAT-RESISTANT
NON-INFLAMMABLE • WATER-RESISTANT
NON-CRYSTALLIZING at LOW TEMPERATURES

The new BH Extra Flexible Fiberglas Sleeving is woven from the choicest continuous-filament Fiberglas yarns. It possesses high dielectric strength, is water-resistant and, like all BH Sleeving and Tubing—is non-inflammable.

All sizes from No. 20 to 5/8", inclusive, are available. Write for samples of this radically new and different sleeving today—in the sizes you desire. Seeing is believing! Bentley, Harris Manufacturing Co., Dept. W, Conshohocken, Pa.

BH PRODUCTS

NON-BURNING IMPREGNATED MAGNETO TUBING • NON-BURNING FLEXIBLE VARNISHED TUBING • SATURATED AND NON-SATURATED SLEEVING

BENTLEY, HARRIS MANUFACTURING CO.
Conshohocken, Penna.

Working Now with Manufacturers

not only on Today's Production Problems but also on Reconversion Plans

Lighting is a production tool that must meet the specifications set by the Seeing Task if it is to return the maximum on the investment. To secure such lighting, requires not only fixtures which conform to the most exacting mechanical, electrical and illumination specifications, but also the proper selection, installation, and maintenance of these fixtures.

Illumination engineers and lighting specialists connected with the electric light and power company serving you, or with the electrical wholesalers from whom you procure your Benjamin lighting fixtures, and the Field Engineers of this company, have special training in the science of seeing and the fundamentals of lighting practice.

They have in their *heads* a thorough understanding of the best application of the various types of lighting units available for the solution of your specific lighting and seeing problems.

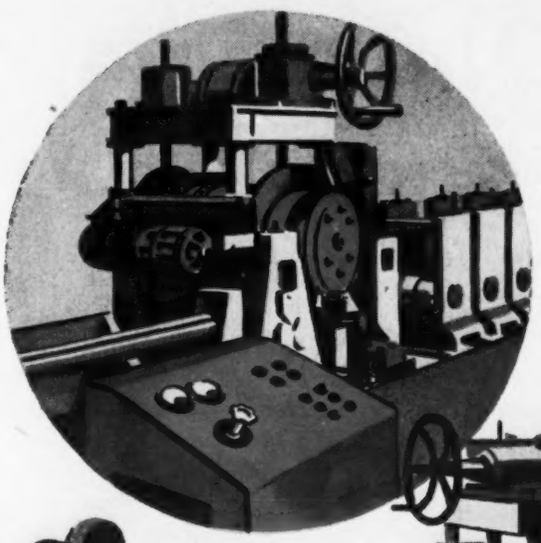
These men work closely with your own plant and consulting engineers. Their experience and training is available freely, without cost or obligation on your part, to analyze your lighting and make recommendations for the improvement of present lighting for increased war production. Their services also should be utilized, now, to help in the development of a program of lighting betterment as part of your reconversion plans for the post-war period.

BENJAMIN
TRADE MARK

Lighting Equipment

Distributed Exclusively Through Electrical Wholesalers

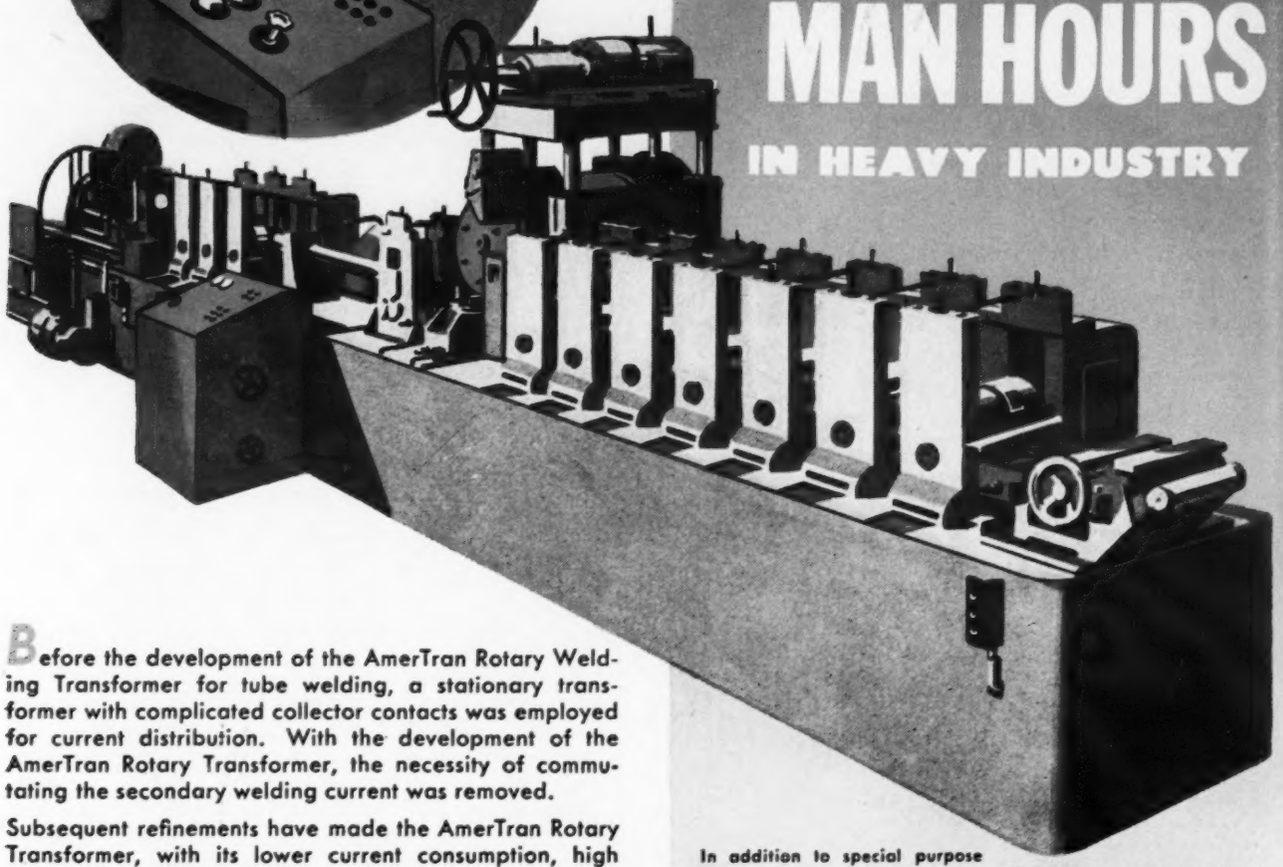
Send for a copy of this FREE BOOKLET containing much valuable information on how to obtain best lighting results. With it will be sent complete information on how you may obtain the assistance of the Benjamin Field Engineer in analyzing the performance of your lighting and in making recommendations. Address Lighting Service, Benjamin Electric Mfg. Co., Dept. K, Des Plaines, Illinois.



AMERTRAN

FINDS LOST MAN HOURS

IN HEAVY INDUSTRY



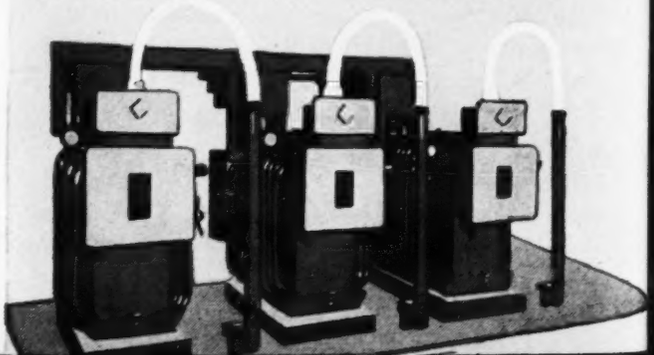
Before the development of the AmerTran Rotary Welding Transformer for tube welding, a stationary transformer with complicated collector contacts was employed for current distribution. With the development of the AmerTran Rotary Transformer, the necessity of commutating the secondary welding current was removed.

Subsequent refinements have made the AmerTran Rotary Transformer, with its lower current consumption, high power factor, small leads and positive non-leaking cooling, a most economical unit. Used in conjunction with the AmerTran Transtat Voltage Regulator, it is a most efficient power supply for tube welding.

This is merely one of the many instances where AmerTran transformer engineering has saved time and cut costs for heavy industries. Our versatile, flexible manufacturing facilities insure the speedy completion of even larger projects. And our long association with radio, as well, assures authoritative design and engineering service for your electronic control and rectifier needs. Write us today, outlining your problems.

AMERICAN TRANSFORMER COMPANY, 178 Emmet St., Newark 5, N. J.

In addition to special purpose transformers, the American Transformer Company manufactures a wide range of conventional types, such as the Abestol Immersed Distribution Transformers shown below.

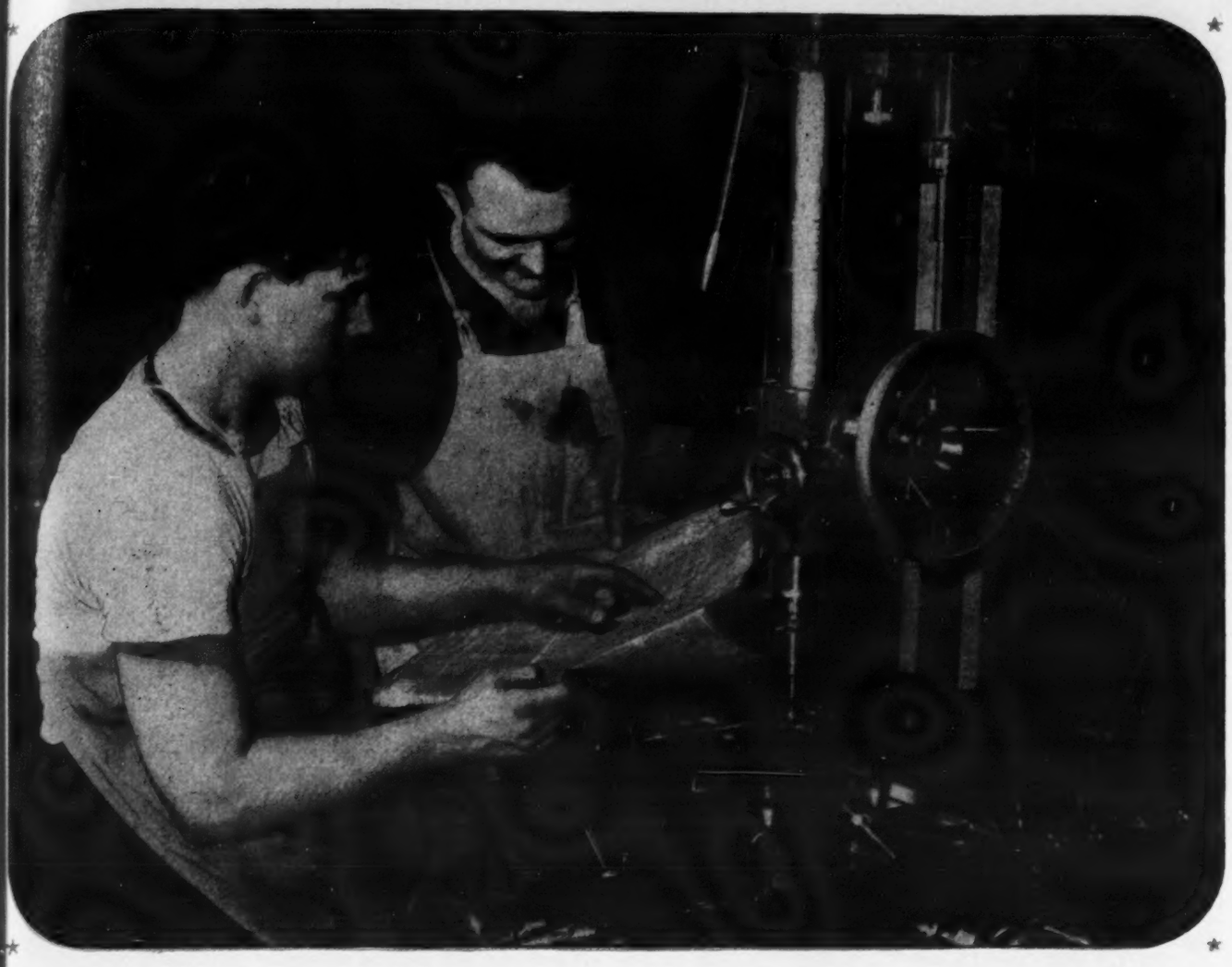


AMERTRAN

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

AMERTRAN

MANUFACTURING PLANT AT NEWARK, N. J.



One of these Days THEY'LL BE WORKING TO A DIFFERENT SET OF BLUEPRINTS

HAND BOOK OF SPECIAL STEELS

Newly revised and reprinted—a comprehensive book on the properties, uses, and best methods of handling, treatment, etc. of tool, stainless and other alloy steels. Plenty of tables to facilitate quick reference and selection. 136 pages, pocket-sized, latest data.

SEND FOR YOUR COPY

Address Dept. EW-22

A GREAT many companies—yours probably included—already have a clear idea what items those new blueprints will cover. One thing's sure: whether your future products stay in familiar fields or enter new markets, they'll have to be as modern and value-packed as your engineers can make them. Improved design, and the use of better materials, are the means to the end.

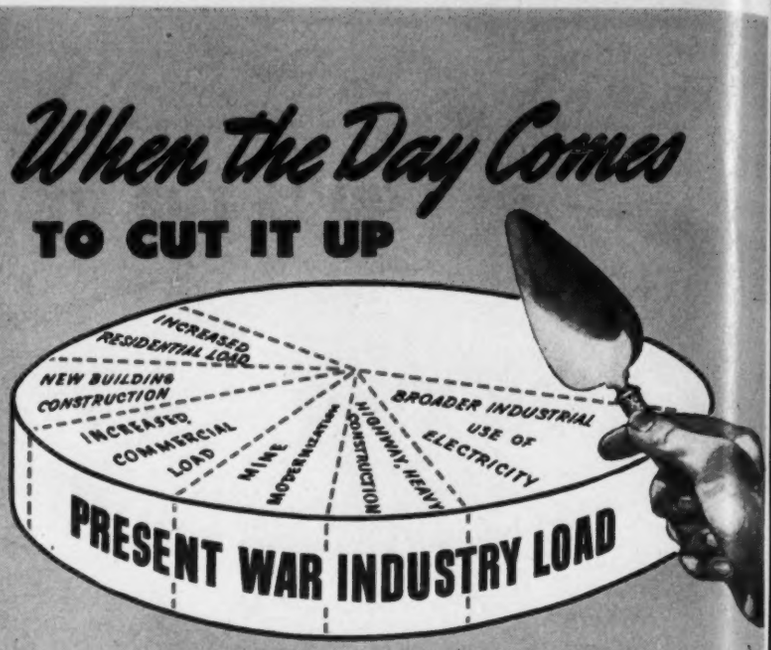
You'll find a lot of your "better materials" answers among the various Allegheny Ludlum families of special, high-alloy steels. If you're looking for such qualities as improved electrical characteristics, finer appearance, greater strength, resistance to heat, wear or corrosion, etc., we have the design and production data you need. Let our Technical Staff help with your plans.

Allegheny Ludlum
STEEL CORPORATION
GENERAL OFFICES: BRACKENRIDGE, PENNA.

W&D A-9330

Why is Jones better than Smith?
ON YOUR POSTWAR PAYROLL will be two men—let's call them Tom Jones and Fred Smith. They will do identical work. They will receive identical pay. Yet Jones will be better than Smith—produce better, faster, at lower cost. Why? Because Smith is "another-machine". Tomorrow Jones and Smithing slow him up. Industry knows the answer—and so do you. It's a number's air conditioning —and the figures are available on what it promises for lower postwar costs. Don't stumble in as a fad. Your competitors aren't. Talk to the man in your town who is ready to help you plan for it now.
HOW YOUR LIGHTING COMPANY CAN HELP YOU CUT POSTWAR COSTS
ROEBLING
PACEMAKER IN WIRE PRODUCTS

Tomorrow's Mines will MODERNIZE Electrically
ADEQUATE WIRING NEARS MORE ORE PRODUCTION
ROEBLING
PACEMAKER IN WIRE PRODUC



We hope this ROEBLING advertising will have helped pave your way

When your problem changes from generation to distribution again—when heavy war plant loads drop off and you are seeking to spread generating capacity across a broad range of users, we hope these 1944 Roebling messages will have helped pave your way.

They are telling the story of better utilization of electric power in six important magazines to 116,000 industrial executives, mine owners, and building contractors regularly—and referring them all to their local electric companies for help in planning now—to cut costs later.

And, when it comes to the wires and cables you will need for that big distribution job, and for replacement of those that need it now, remember Roebling as *wire specialists* ready to supply the right conductor for every need.

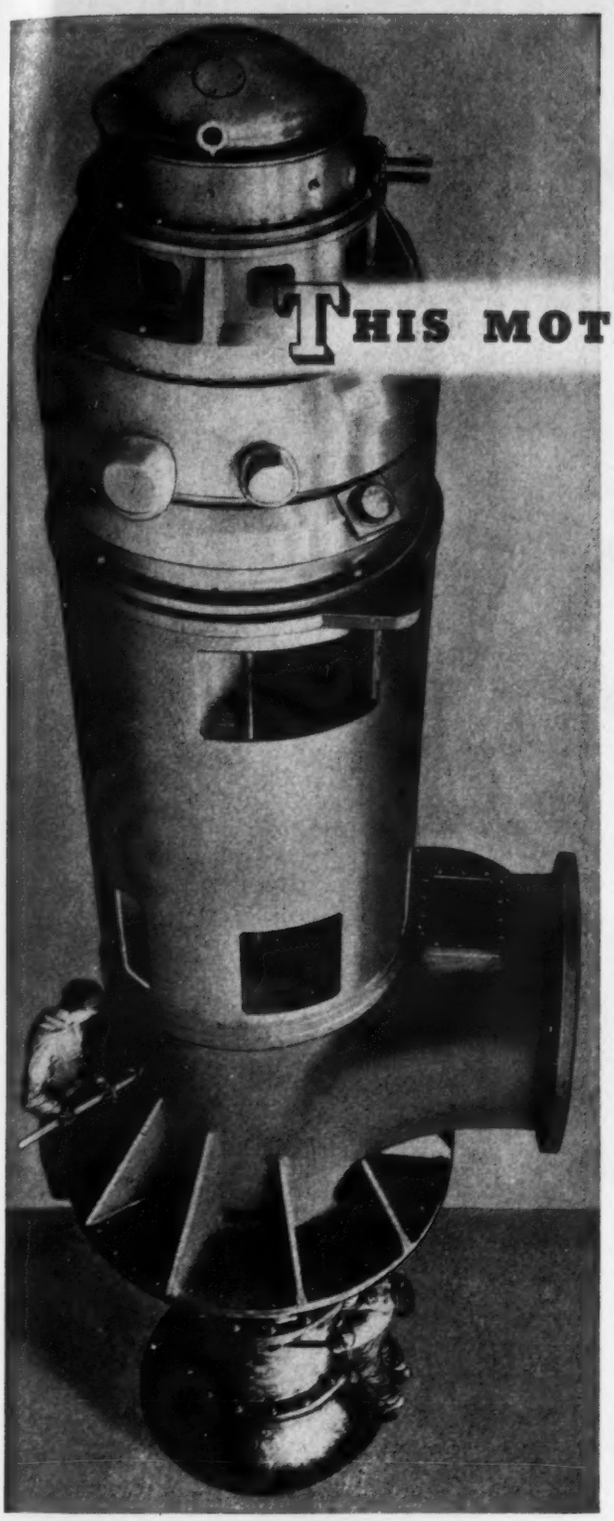
JOHN A. ROEBLING'S SONS COMPANY, TRENTON 2, NEW JERSEY

Branches and Warehouses in Principal Cities

ROEBLING

PACEMAKER IN WIRE PRODUCTS

WIRE ROPE AND STRAND • FITTINGS • SUSPENSION BRIDGES AND CABLES • ELECTRICAL WIRES AND CABLES • COLD ROLLED STRIP ROUND AND SHAPED WIRE • HIGH AND LOW CARBON ACID AND BASIC OPEN HEARTH STEELS • WIRE CLOTH AND NETTING • AIRCORD, SWAGED TERMINALS AND ASSEMBLIES • AERIAL WIRE ROPE SYSTEMS



THIS MOTOR PUSHES A "RIVER"

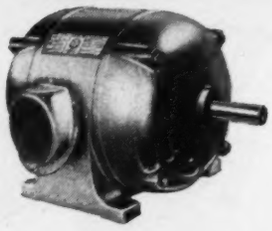
Surface condensers for power generating stations require the pumping of literally "rivers" of water. 40,000 gallons per minute is a lot of water, yet that is the capacity of this vertical, propeller-type circulating pump—a type now being used by a number of large utility companies.

To push that much water around takes plenty of power, and this specially designed Westinghouse motor delivers the 350 hp punch necessary to do the job.

You'll probably never need a motor to "push a river"—but the same kind of engineering skill that goes into such specialized motor jobs is back of every Westinghouse motor you buy.

This ready-to-use experience is available to you for wartime needs—or in planning for postwar conversion. It can help you solve any drive problem quickly—with a motor exactly fitted to the job. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

J-21300

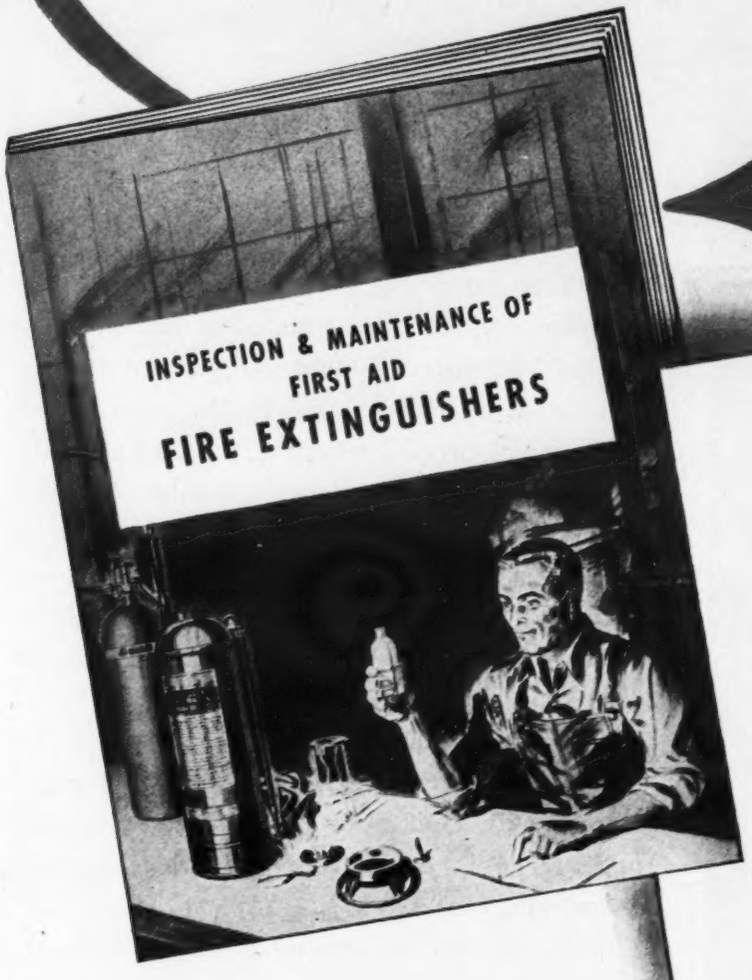


This is only one of the many Westinghouse general-purpose motors available in standard and special enclosures. Features include choice of sealed-sleeve or ball bearings, Tuffernell insulation; dynamically balanced rotor, rigid one-piece frame; die-cast rotor; radio-frequency tested insulation.

Westinghouse motors

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Let this FREE BOOK help you keep your fire-fighters ready for action!



PARTIAL LIST OF CHAPTERS

- WHO'S IN CHARGE?
- KEEPING RECORDS
- WHAT KIND OF EXTINGUISHERS?
- MARKING LOCATIONS
- MARKING THE EXTINGUISHERS
- INSPECTION OF EXTINGUISHERS
- VAPORIZING LIQUID EXTINGUISHERS
- CARBON DIOXIDE EXTINGUISHERS
- SODA-ACID EXTINGUISHERS
- FOAM EXTINGUISHERS

NEGLECT of your extinguishers may leave them damaged, clogged, under-charged —*unprepared* at the critical moment when you need them. Only careful examinations at fixed intervals can insure the full effectiveness of your equipment at all times.

To make it easy for you to organize your own maintenance system, Walter Kidde & Company has issued this booklet. The panel at the right gives some idea of its scope. Take the first step toward better fire protection now—write for your free copy of this booklet!

WALTER KIDDE & COMPANY, INC., 525 MAIN STREET, BELLEVILLE, N. J.

PUT YOUR INCREASED *Spring* LOADS UP TO FWD's

Line materials and equipment are taking a hard-beating in war service on the home front. With Spring will come an increased surge of emergency and routine maintenance work. Trouble-shooting crews will be shorthanded. They will need the speed and stamina of FWD's more than ever before.

FWD's are "old-timers" in public utility service and maintenance work. From coast to coast . . . from Mexico to Alaska . . . they are the "preferred stock" in trucks. More than 150 Public Utilities operate fleets . . . of more than 200 in many cases . . . all year 'round.

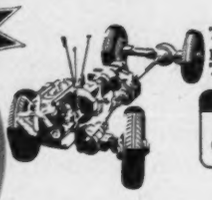
Treat your FWD's right and they'll serve you reliably. Call the nearest FWD factory branch, district service man, or dealer regularly for sound maintenance advice and skilled service.

THE FOUR WHEEL DRIVE AUTO COMPANY, Clintonville, Wisconsin

Canadian Factory: KITCHENER, ONT.

★ FOUR WHEEL DRIVE *Hauling Power* HELPS RELIEVE SHORTAGE OF *Manpower*

You can make the most of available manpower with FWD's in maintaining vital communication and power lines...both of which are needed still more in 1944 to clinch Victory. Keep FWD's on the job!



The True Four-Wheel-Drive Principle With Center Differential Saves: Tires • Gas • Oil • Replacements

THE OLDEST AND ORIGINAL EXCLUSIVE . . . *BUILDERS OF FOUR-WHEEL-DRIVE TRUCKS*

IN EVERY FIELD WHERE TRUCK QUALITY IS PUT TO THE TEST . . . FWD's STAND UP

Norelco QUALITY CONTROL begins at the beginning!

Drilling a Diamond

An example of how NORELCO quality control begins at the beginning is the fine wire which goes into the central elements of the 4-window X-ray Diffraction Tube illustrated below. The tungsten is of our own manufacture. It is drawn into wire in our own plant . . . through diamond dies of our own drilling.

Quality control that begins at the beginning is common to all NORELCO Electronic Tubes. That is why they can be depended upon for high efficiency, consistent performance and long life.

Although all the tubes we produce are now going to the armed forces, we invite inquiries from prospective users of various types of Transmitter, Amplifier, Rectifier, Cathode Ray and Special Purpose Electronic tubes. A list of tube types we are especially equipped to produce for commercial communications equipment and industrial applications will be sent on request.

In addition to electronic tubes and quartz crystals for military communications on land, sea and in the air, we make for our war industries: Searchray (X-ray) Apparatus for Industrial and Research Applications; X-ray Diffraction Apparatus; Direct Reading Frequency Meters; Electronic Measuring Instruments; High Frequency Heating Equipment; Tungsten and Molybdenum Products; Fine Wire in many metals and various finishes; Diamond Dies.

And For Victory We Say: Buy More War Bonds

Norelco ELECTRONIC PRODUCTS by NORTH AMERICAN PHILIPS COMPANY, INC.

Executive Offices: 100 East 42nd Street, New York 17, New York
Factories in Dobbs Ferry, New York; Mount Vernon, New York (Metalix Division); Lewiston, Maine (Elmet Division)

UNIFORMLY PERFECT PERFORMANCE every time

with

Nichrome*

made only by

Driver-Harris

NICHROME* is the nearest approach to the theoretically perfect resistance alloy. Throughout the entire engineering world NICHROME* is synonymous with ideal heat and corrosion resisting alloy. This unique nickel-chromium combination has performed its way to leadership and become the time-tested standard of quality.

To produce such a universally accepted product requires more than the combining of metals. It calls for complete mastery of improved heating and quenching techniques, application of exclusively developed D-H quality controls. Above all, it requires that profound knowledge of alloys possessed by Driver-Harris specialists . . . scientists who have devoted 45 years to the continuous perfection of NICHROME*.

Your post-war products will last longer . . . operate more dependably if you specify NICHROME* and other D-H resistance alloys in their design considerations.

*Trade Mark Reg. U.S. Pat. Off.

D H

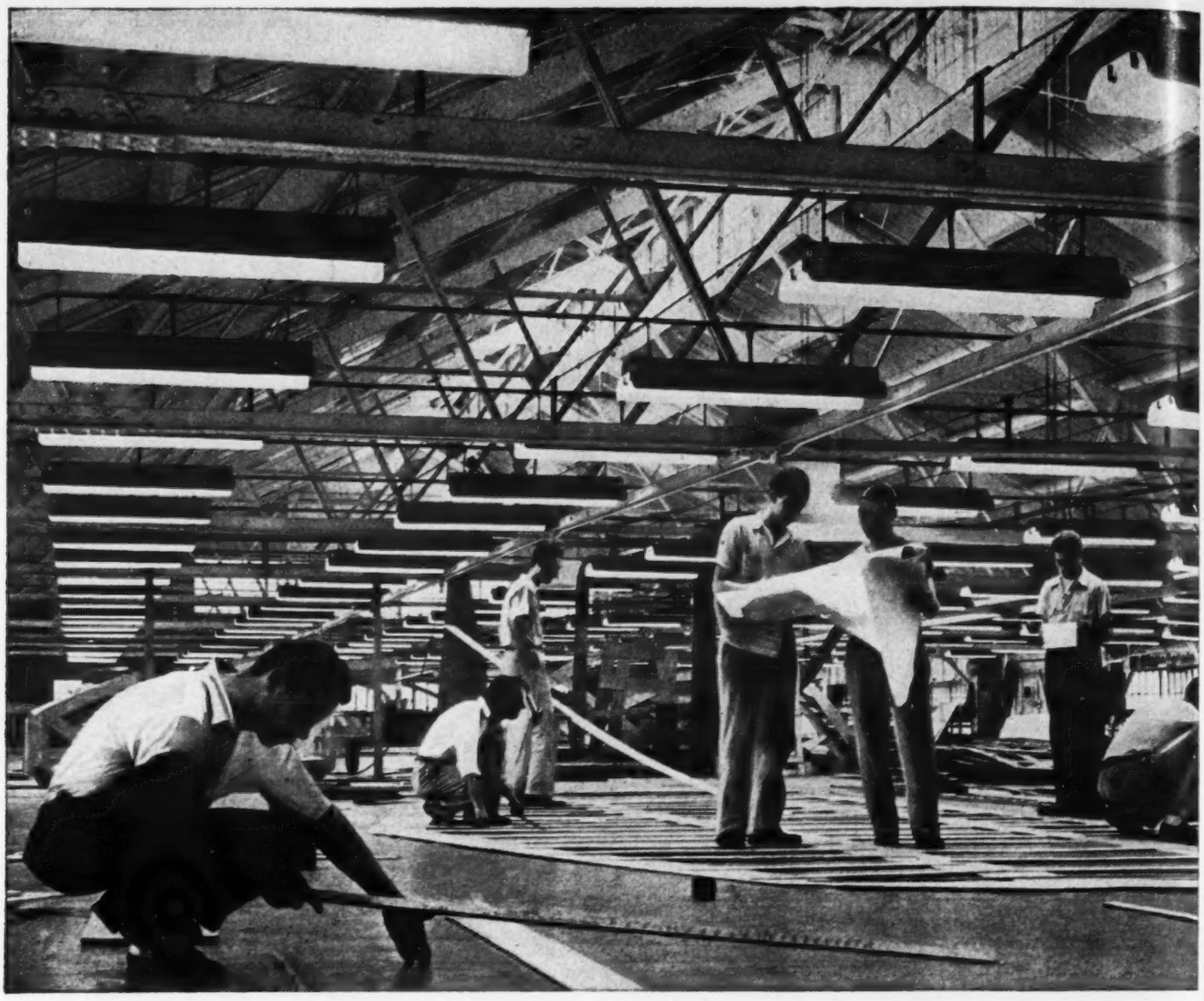
SPECIAL PURPOSE ALLOYS SINCE 1899

Driver-Harris COMPANY

HARRISON, N. J.

CHICAGO • DETROIT • CLEVELAND • LOS ANGELES • SAN FRANCISCO • SEATTLE

200 ACRES OF



Westinghouse

MAZDA LAMPS FOR SEE-ABILITY

LET'S ALL KEEP BACKING THE ATTACK . . . BUY MORE WAR BONDS!

Enjoy the Westinghouse radio program with John Charles Thomas—NBC, Sunday, 2:30 p.m., E.W.T.

BLUEPRINTS TO CHECK

See-ability, made possible *by today's high-efficiency Westinghouse Mazda Lamps, is helping build the greatest fleet in history. In one shipyard alone, draftsmen and engineers must work with more than 200 acres of blueprints in a single year. See-ability makes this vital eye-work easier, enables ship-building Americans to work faster and more accurately, with a minimum of fatigue. Through See-ability, efficiency is increased, output speeded, eye-strain reduced. For maximum See-ability and efficient, dependable service, be sure to recommend bright, long-lasting Westinghouse Mazda Lamps. Westinghouse Electric & Mfg. Co., Bloomfield, N. J. Plants in 25 cities . . . offices everywhere.*

Wartime lighting advances made by Westinghouse engineers will lead to higher lighting standards for postwar America, with new and better ways of using light in every kind of business, industrial, transport, commercial and home activity. Higher levels of light for schools will bring easier seeing, faster learning, better work. Light in new colors, lamps in new shapes and sizes, will offer a host of new display and merchandising opportunities to progressive stores and show rooms. Whatever your plans, be sure you take full advantage of Westinghouse lighting improvements.

Life ON THE PLASTICS NEWSFRONT

(*Above*) **MELMAC* LAMINATES** fabricated by The Formica Insulation Company are used as electrical insulation, in mechanical applications, and for decorative sheets. Sample at left is ½" glass fabric panel with flash adhering; at right, 1/16" asbestos paper base, ½" glass fabric, and 1½" muslin base.

(*Right*) **FLAME RESISTANCE TEST,** made by The Formica Insulation Company, demonstrates the relative flame resistance of phenolic (left) and melamine (right) laminates. As shown, the phenolic is burning, while melamine, such as Cyanamid's MELMAC, fails to support combustion. Both samples are cellulose base laminates. Non-inflammability and high heat resistance are characteristic of MELMAC, Cyanamid's melamine laminating resin, as well as all MELMAC molding compounds.

(*Left*) **LATEST TECHNICAL DATA** on MELMAC plastics is now available in the new manual, "MELMAC MOLDING COMPOUNDS." Copies will be sent on request to designers, engineers, and others interested in the use of plastics now or postwar.

(*Above*) **BATHROOM LIGHTING FIXTURES** molded of pearl white BEETLE* by Universal Plastics Corporation for the Lightolier Co. have the advantages of color, light weight, shatter resistance, and hard surface, can be mass-produced economically.

Center photo shows molding of the lamp housing from preheated BEETLE to produce a finished piece superior in appearance and extremely resistant to service conditions. Lower photo shows assembly line where socket and lens are inserted and shade and base fastened with metal spring clip.

If quick, low-cost manufacture of lighting equipment may be the solution to your needs, your molder will work with you in adapting BEETLE to new designs and requirements.

*Reg. U. S. Pat. Off.

AMERICAN CYANAMID COMPANY

PLASTICS DIVISION

30 ROCKEFELLER PLAZA • NEW YORK 20, N. Y.

Cyanamid Plastics • BEETLE • MELMAC • URAC • MELURAC • LAMINAC

The Line-Servicing Truck That Goes *As the Crow Flies . . .*

● Getting *to* the job is frequently the hardest part of the line construction, maintenance and repair service of a public utility. Telephone, telegraph and power transmission lines cut across fields, over deserts, through forests, wherever possible. Getting men and equipment to the spot where they are needed is a problem—especially when the terrain is soft or covered with snow.

Many public utilities solve this problem by equipping their field crews with Marmon-Herrington *All-Wheel-Drive* converted Ford trucks. Here, as in road construction and maintenance, including snow-removal, and in the oil fields, mining and logging operations, etc., *power applied through all wheels is the answer.* The ability of these trucks is actually amazing where the "going" is tough, as has been proved on all the battle fronts of the war. Marmon-Herrington *All-Wheel-Drives* are the world's best buy for the extra-difficult civilian jobs when peace comes. Your War Savings Bond purchases will help speed that day.

MARMON-HERRINGTON

All-Wheel-Drive

MARMON-HERRINGTON CO., Inc. • INDIANAPOLIS 7, INDIANA

Cable Address: MARTON

A Single Cardox System Provides Engineered Extinguishing Coverage for One or a Number of Hazards . . . Large and Small

The swift efficiency of carbon dioxide for fire extinguishment is thoroughly recognized. But, where a few pounds, properly applied, will stop one fire, another may call for tons . . . for example, to provide total flooding of large plant production areas, or for severe outdoor hazards.

With the Cardox method of control and engineered application, Cardox CO_2 —supplied instantly *in pounds or tons* —gives new protection scope to this non-damaging, non-contaminating medium for fire extinguishing.

Enhanced CO_2 Performance

A Cardox System—engineered for the specific hazards it covers—extinguishes fires by a timed *mass* discharge of Cardox CO_2—stored at 0°F. in a mechanically refrigerated Storage Unit.

Enhanced extinguishing performance is possible because, as controlled and applied—*in pounds or tons*—in Cardox Systems: (1) Cardox CO_2 has uniform extinguishing characteristics regardless of plant or atmospheric temperatures; (2) Applications can be engineered in accordance with the requirements of each specific hazard covered; (3) High CO_2 snow yield provides increased cooling effect (carbon dioxide released at 0°F. yields 45% CO_2 snow); (4) Effective projection through relatively great distance is achieved—even outdoors.

Tough Hazards Have "Engineered" Cardox Systems

It is no coincidence that frequently when hazards are toughest to handle . . . where fire or damage by the extinguishing medium would disrupt carefully planned war goods production schedules . . . engineered protection is provided by Cardox Fire Extinguishing Systems.

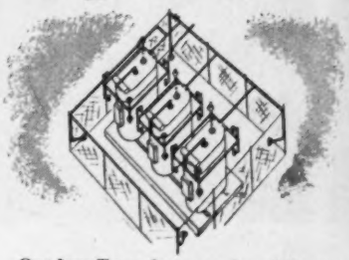
If you would like more information for use in solving current war plant fire protection problems . . . or in formulating fire protection plans that will prevent dangerous delays in getting post-war production in high gear . . . write on company letterhead for Bulletin 554.

CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS
District Offices in
New York, Boston, Washington, Detroit, Cleveland, Atlanta, Pittsburgh, San Francisco, Los Angeles, Seattle

CARDOX
CO_2 FIRE EXTINGUISHING SYSTEMS

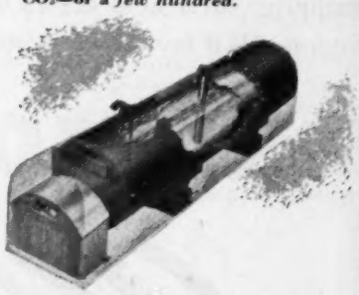
FOR EXAMPLE

These sketches illustrate simply the broad scope of protection that can be provided by a *single* Cardox System. The range of efficient applications between these extremes is practically unlimited.



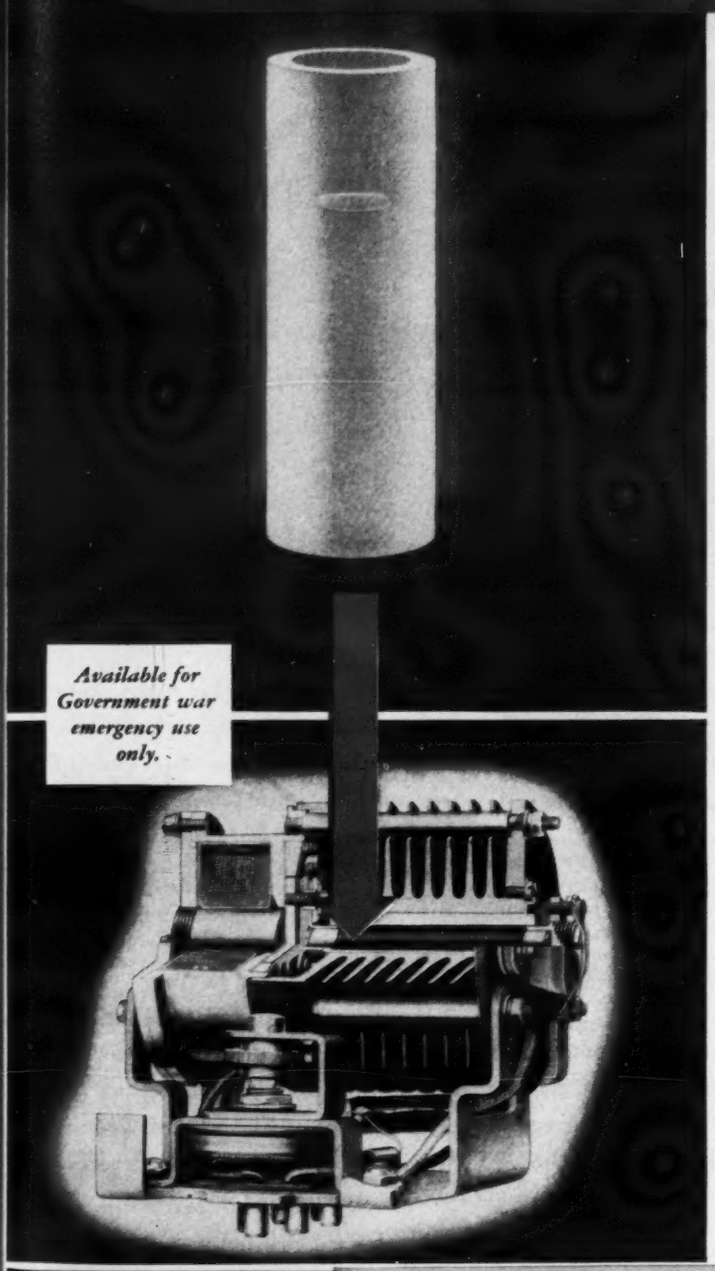
Outdoor Transformers. Local direct application at very high rate builds area flooding effect outdoors. For hazards such as this a Cardox System stands ready at the first flash of fire with *tons* of Cardox CO_2, if needed.

Cardox Hose Reel provides effective protection for numerous hazards calling for a *few pounds* of Cardox CO_2—or a *few hundred.*



Cardox CO_2 is supplied instantly in pounds or tons from a single Storage Unit containing 500 pounds to 125 tons at controlled low temperature of 0°F. and 300 p.s.i.

THE LITTLE GLASS TUBE THAT HELPS KEEP PLANE VOLTAGES CONSTANT...



Available for Government war emergency use only.

IT doesn't look exciting but this little Corning precision tube is flying in our planes to help them out-perform those of our enemy. It is the "heart" of an important piece of apparatus called a carbon pile voltage regulator.

As the name implies, the function of this equipment is to provide even, continuous voltage regulation without lag or fluctuation. This is accomplished by pressure exerted on a stack of carbon discs.

The tube which contains these discs must be smooth, accurate in dimensions and capable of withstanding high temperatures. For it, Eclipse-Pioneer engineers have chosen a precision ground Pyrex tube with an outside diameter of .6245 plus 0 minus .001 inches and an inside diameter of .435 plus or minus .002 inches. Tolerances unheard of five years ago except for optical purposes!

Perhaps Corning's "know how" in glass may some day be of use to you, too. Under the Army-Navy "E" flag at Corning you'll find glasses with high dielectric strength, extreme resistance to thermal or mechanical shock or any combination of these qualities needed to fit your particular requirements. Just to keep you informed we'd like you to have a free study called "There Will Be More Glass Parts In Post-War Electrical Products." Write for your copy to the Electronic Sales Dept. W-5, Bulb and Tubing Division, Corning Glass Works, Corning, New York.

Photo Courtesy Eclipse-Pioneer Division of Bendix Aviation Corporation

CORNING *means* Research in Glass

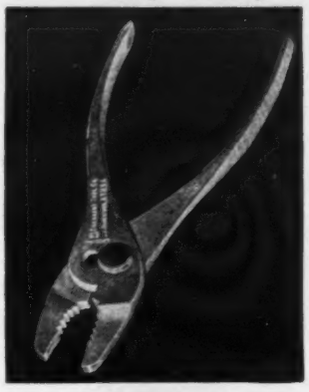
Electronic Glassware

T.M.REG. CORNING U.S. PAT. OFF. T.M.REG. PYREX U.S. PAT. OFF.

"PYREX" and "CORNING" are registered trade-marks of Corning Glass Works

This TOOL for a LIFE RAFT is part of our POSTWAR PLANNING

Here you are miles from nowhere in any direction. Just a sitting duck with no place to go but the way the sea decides to take you. Above, a blazing, searing sky; below you, water that only helps the sun to boil you beautifully, lobster fashion. That, and many times worse, is what it's like to be *down at sea.*



This is the Crescent "Tool Kit" for Life Rafts. Five inches long; extremely light weight; the point of one handle serves as a screw driver; has wire-cutting jaws and is cadmium plated to protect it against salt spray.

Several years ago . . . long before Pearl Harbor . . . Crescent was asked by the Army Air Forces to supply a sufficiently versatile tool with which to equip their rubber life rafts. After many tests, this tool turned out to be a special, light-weight Crescent Slip-joint plier with a Cadmium finish designed to withstand the ravages of anything from humid jungle to Arctic cold or salt spray corrosion. In those early days, a plier was the only tool in the kit. Since then, other tools have been added. Today, this precious little Crescent Plier is used on the life rafts of our armed forces.

Point is, that here and in many other instances where we have been producing the finest possible *tools of war*, we have unconsciously been doing some post-war planning in the bargain. Because of this little slip-joint plier for life rafts, our future tools are going to be better . . . more efficient and longer lasting.

When the skies of battle clear, and we are released of our duty to the nation, we will be offering the finest tools to ever carry the Crescent name. To most of us, *War Bonds* are the only means available to speed that day. Crescent Tool Company, Jamestown, N. Y.

Iceland — NEXT STOP

STEPPING-STONE between America and her allies where North Atlantic convoys change escorts, Iceland is made more livable for our troops by electric light.

Meeting wartime requirements for electric light and power here at home, central stations everywhere are using *Texaco* to maintain peak output.

Texaco Regal Oils (*R&O*), for example, keep steam turbine systems clean, bearing temperatures normal, governor action smooth and sensitive. These oils free themselves rapidly from air and water, are highly resistant to gum formation and sludging and *are rust and oxidation inhibited.*

So effective have Texaco lubricants proved that they are definitely preferred in many fields, a few of which are listed at the right.

Texaco Lubrication Engineering Service is available to you through more than 2300 Texaco distributing points in the 48 States. The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

★More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

★More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

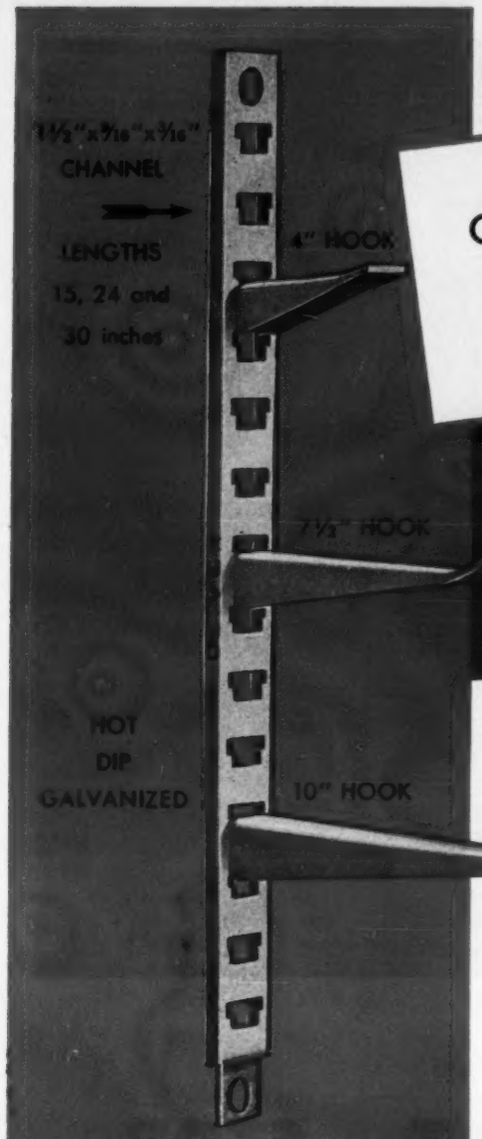
TEXACO

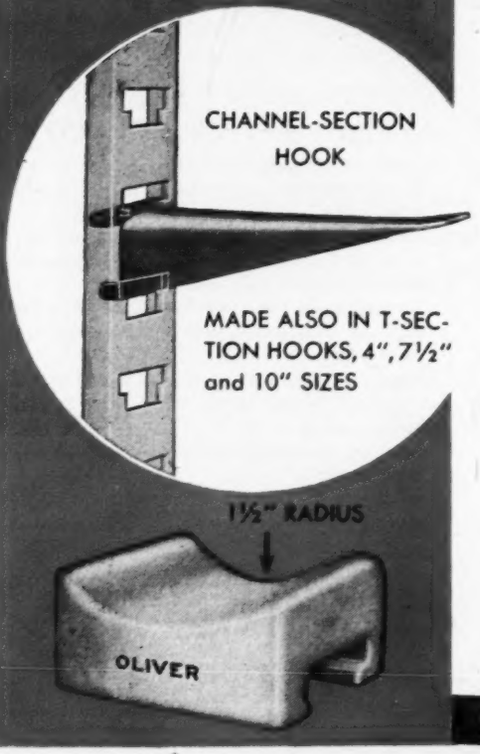
REG. T.M.

TEXACO Regal Oils (R & O)

FOR ALL TURBINES

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT — CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY





... from the
COMPLETE LINE OF
OLIVER
LINE MATERIALS

OLIVER

Underground Cable Racks

For neat, permanent installations of manhole and interior cable work, use Oliver Underground Cable Racks and other line materials. Oliver Racks are readily installed and easily adjusted to conditions (number of cables, size, spacing, etc.). Standard sizes are designed for telephone and smaller diameter power cables. For heavier cables, use Oliver Heavy Cable Racks and Hooks.

RACK HOOKS

Two types of Rack Hooks are available, T-Section and Channel-Section. Both fit the standard rack, are easy to install and have rounded edges and wide bearing surfaces to prevent damage to the cable sheath. Channel-Section hooks have extra interlocking lugs to prevent rotation of the hook during installation of cables.

INSULATORS

For extra protection, Oliver Insulators can be used with either type of hook. Made of white glazed porcelain with a smooth surface and well rounded corners, they prevent damage to sheath due to "creeping" of cable, and provide extra insulation between cable and hooks.

OTHER ITEMS

The complete line of Oliver Underground Materials includes Anchor Bolts, Duct Shields, Dowell Pins, Pulling-in Irons, Manhole Steps and Ladders. All metal items are made of new rolled steel, hot dip galvanized.

OLIVER
IRON AND STEEL
Corporation

SOUTH TENTH AND MURIEL STREETS · PITTSBURGH, PENNSYLVANIA

A NEW COMPACT, SHOCK-PROOF IMPULSE-INITIATED TIMER

. . . . . 71.8% smaller than previous conventional units used for similar applications, Struthers-Dunn Type PSEH-1 impulse-initiated timer has the added advantages of rugged shock-proof construction, easily-accessible contacts, and dust-proof cover. Made in both AC and DC types, it operates the contacts at the end of a delay interval after power has been applied, or after receipt of a momentary impulse from a push-button, limit switch, or other source. The adjustable timing range is 20-to-1. The mechanism is immediately recycling. A double-pole, double-throw auxiliary relay is built in to provide a variety of circuit arrangements common to, or isolated from the control circuit. It can be supplied for AC operation on 110 V. 60 cycles or 25 cycles; 220 V. 60 cycles or 25 cycles; or for DC operation at any specified voltage from 6 to 120 volts. Size of a typical PSEH-1 Timer is 3½" x 3⅝" x 3¾".

STRUTHERS-DUNN, Inc., 1321 Arch St., Philadelphia, Pa.

WRITE *for copy of the Struthers-Dunn Catalog and Relay-Timer Data book.*

●

For details on the Timer illustrated above, please specify Type PSEH-1.

STRUTHERS-DUNN

5,288 RELAY TYPES

DISTRICT ENGINEERING OFFICES: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND
DALLAS • DENVER • DETROIT • HARTFORD • INDIANAPOLIS • LOS ANGELES • MINNEAPOLIS • MONTREAL
NEW YORK • PITTSBURGH • ST. LOUIS • SAN FRANCISCO • SEATTLE • SYRACUSE • TORONTO • WASHINGTON

this SIMPLE, FOOLPROOF WAY

THE De Laval Oil Purifier continuously purifies and dehydrates transformer and circuit breaker oil, making it possible to maintain the oil at high dielectric strength at a single pass and, hence, at materially reduced operating cost. Less time is required to service individual pieces of apparatus. Thus, if it is desired, oil may be dehydrated more frequently so as to constantly maintain it at higher dielectric value at no additional cost.

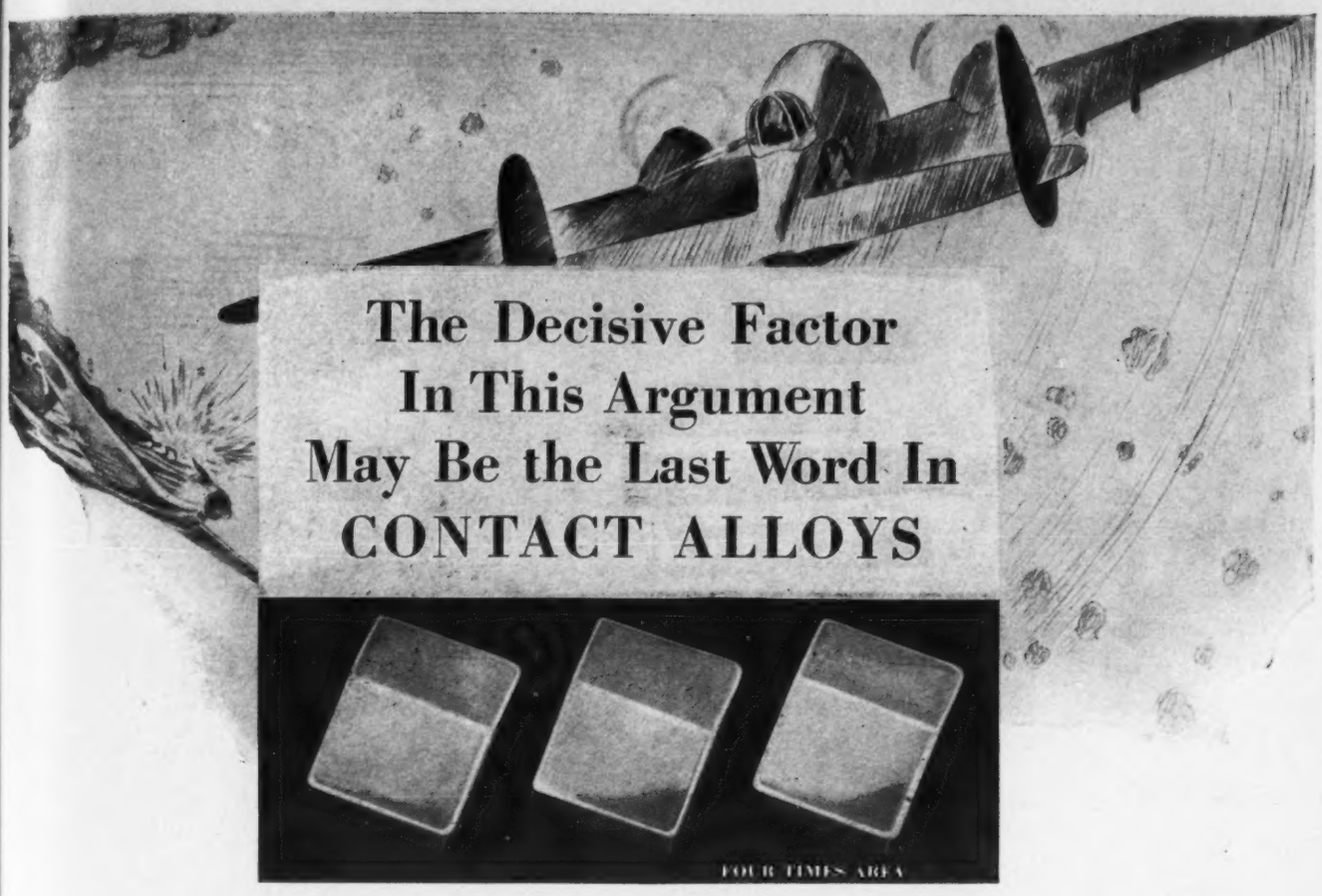
De Laval Oil Purifiers dehydrate oil at relatively low temperature and at constant maximum efficiency. They require a minimum of attendance, since practically automatic operation is made possible by automatic oil flow control and thermostatic heat regulation. Moreover, the De Laval Oil Purifier does not require the aid of a blotter press except to remove colloidal carbon from circuit breaker oil.

All of these factors contribute to dependable, less costly substation performance. Additional details will gladly be sent.

De Laval

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

INSULATING OIL PURIFIERS



The Decisive Factor In This Argument May Be the Last Word In CONTACT ALLOYS

SKILL and nerve are important in combat—but they're not enough without good equipment. A defective wing strut can defeat the bravest pilot. And a little thing like an electrical contact can mean the difference between life and death.

Knowing this, an aircraft company, about to get rolling on a new type of medium bomber, called for the finest contacts that could be made for the job. The contacts were needed for a power-driven gun turret, and so they turned to Mallory.

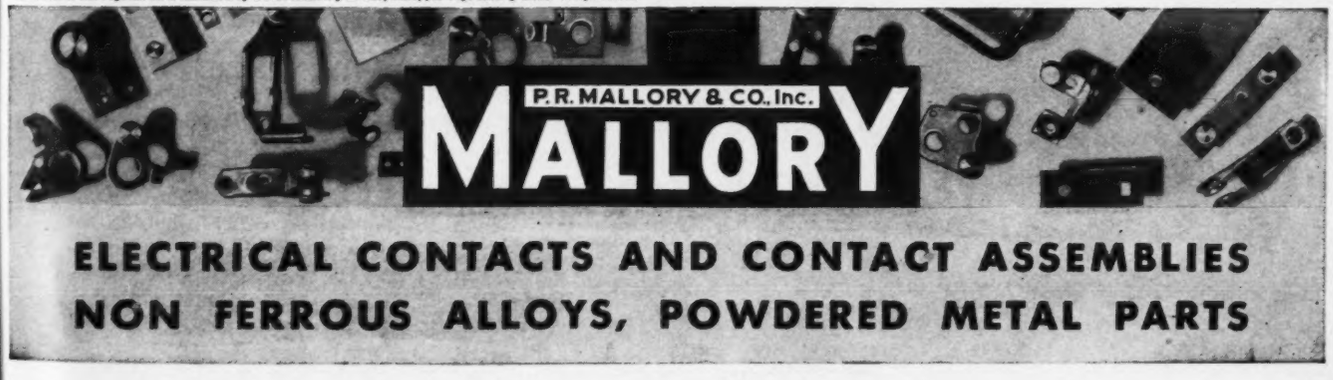
Fortunately, the Mallory policy of continuous development had already produced the needed material, Elkonite* G-12, as well as a superior manufacturing process to give these contacts added life. They had demonstrated consistently a very low contact resistance, and sufficient hardness to wear very slowly. Installed in the relay circuit, Elkonite G-12 passed all short circuit tests—demonstrating, in addition, a remarkably low voltage drop over a long period of operation, avoiding dangerous temperature rise of the contact mechanism and permitting it to run cool and safely under the most severe conditions.

This experience, far from unusual, is another illustration of Mallory foresight combined with technique. How about sharing Mallory "Know how" with you? How about doing it now—while designs are still in the blue print stage?

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

The Harder They Fight, the More They Need— Buy War Bonds

*Elkonite is the registered trademark of P. R. Mallory & Co., Inc., for refractory metal compositions



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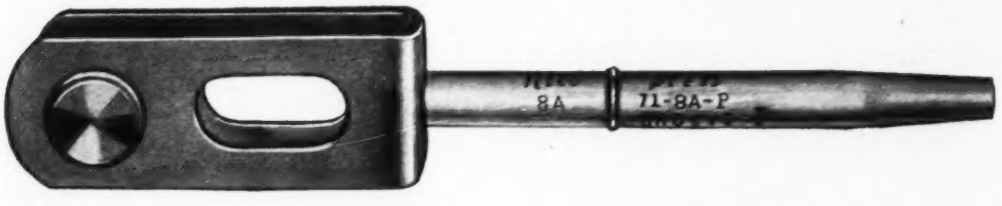

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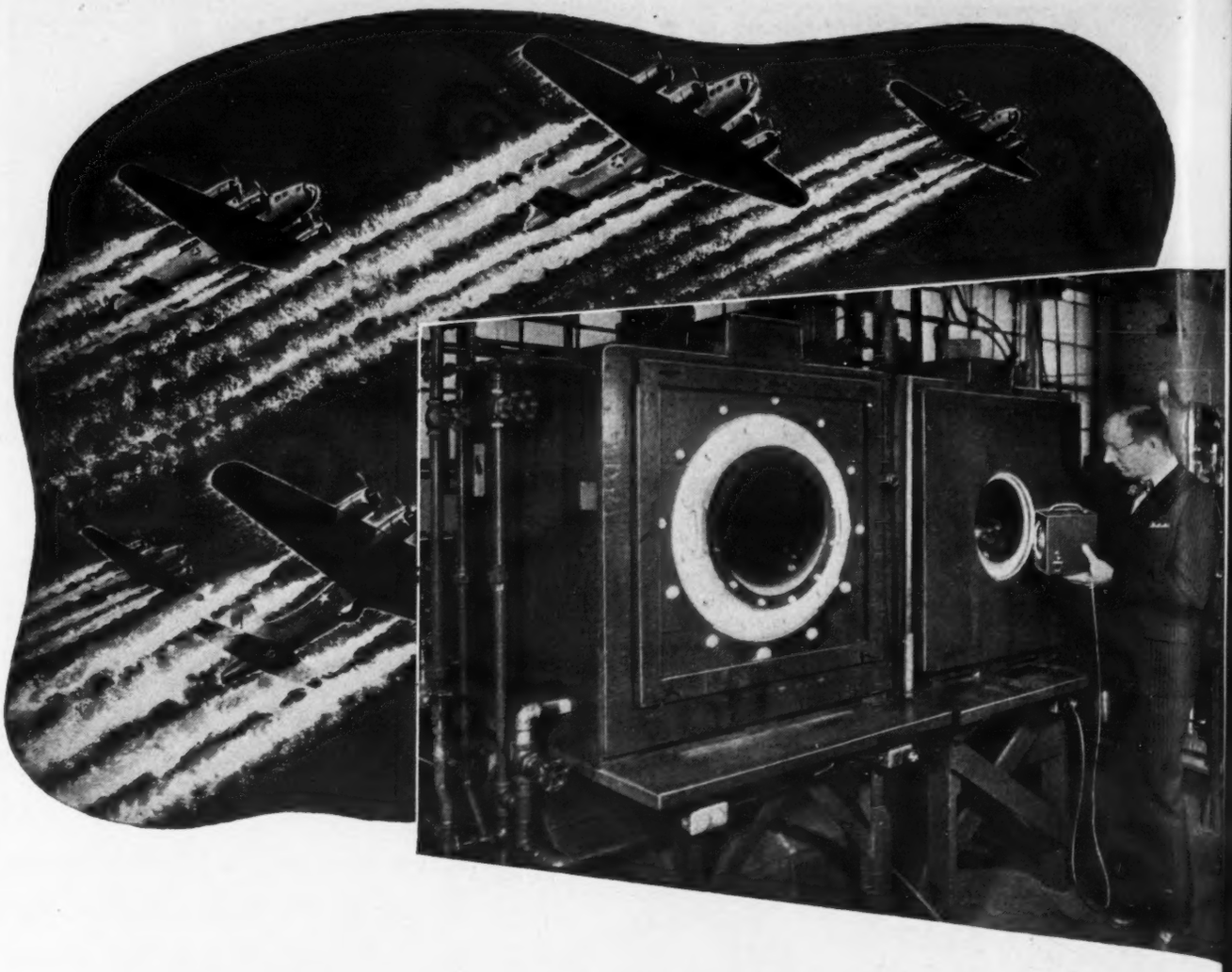

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EXPERIMENTS carried through a step that no one had taken before revealed to National Carbon Company, Inc., research engineers the *cause* of the rapid disintegration of aircraft brushes at high altitudes.

Once the cause of the trouble was known, the remedy could be found. And today, eight new "National" brush grades for aircraft generators, motors, and other rotating electrical equipment are giving *ten times* the service life once obtained . . . from sea level up into the stratosphere.

A small thing . . . of tremendous importance . . . cleared the way for this National Carbon development. It consisted of *drying* the refrigerated, rarefied, test chamber air in which performance of aircraft brushes was analyzed.

No one had done that before for carbon brushes . . . actually brought the stratosphere down to earth so that failing brushes could be closely studied . . . so needed changes could be made . . . until the problem was solved.

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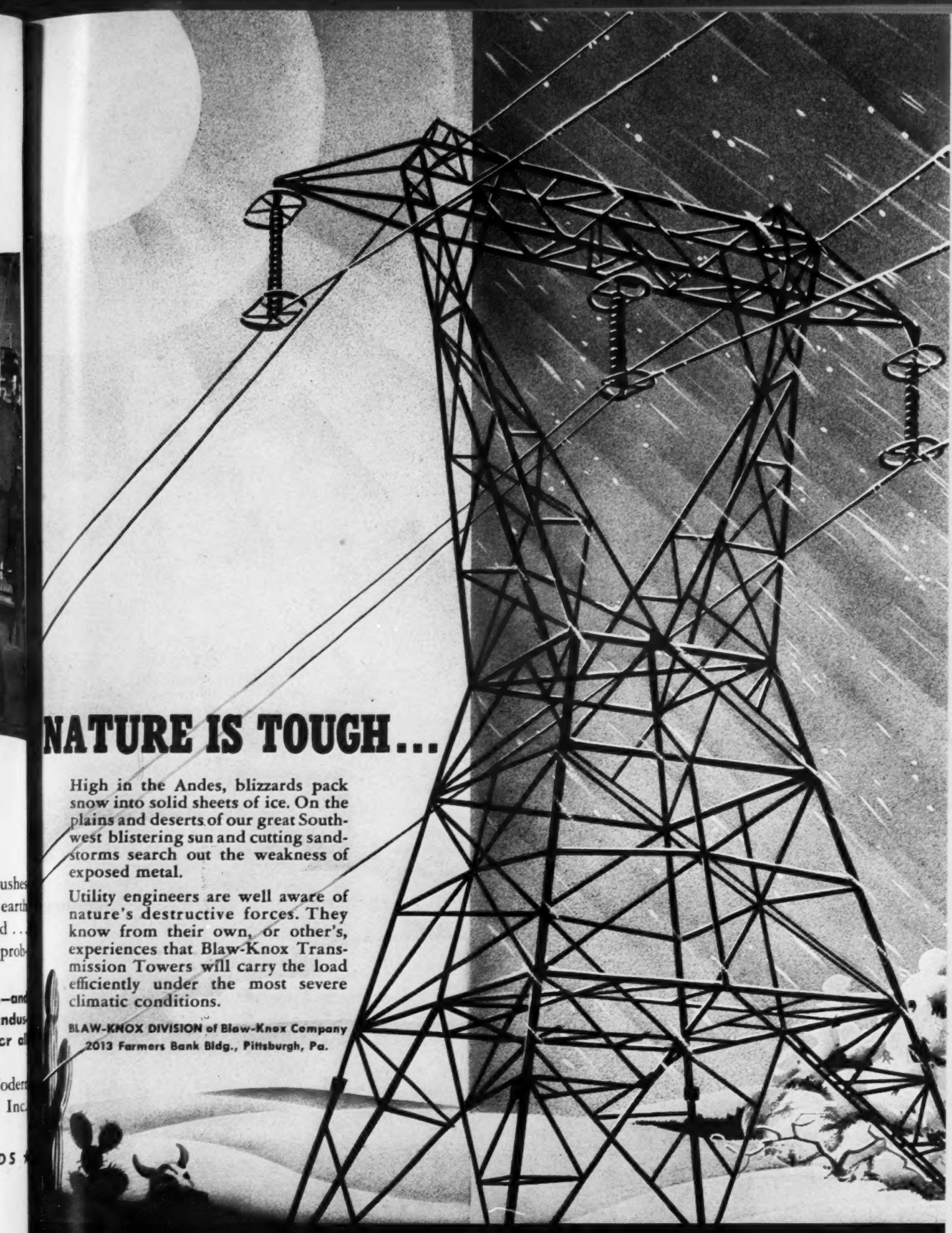

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High in the Andes, blizzards pack snow into solid sheets of ice. On the plains and deserts of our great Southwest blistering sun and cutting sandstorms search out the weakness of exposed metal.

Utility engineers are well aware of nature's destructive forces. They know from their own, or other's, experiences that Blaw-Knox Transmission Towers will carry the load efficiently under the most severe climatic conditions.

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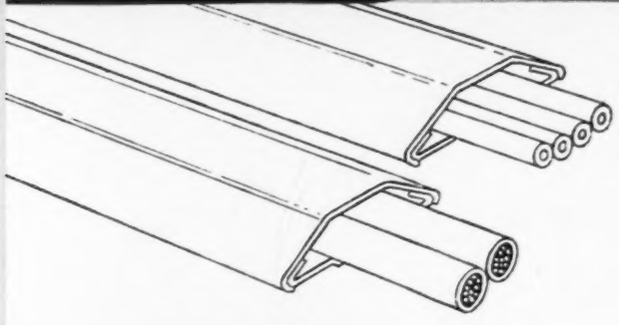
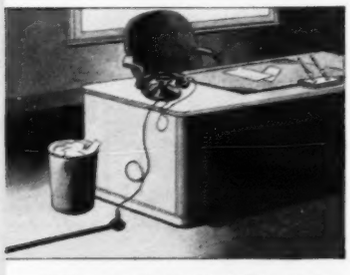


fittings for every requiremen



Office rearrangement solved with convenient "Flordu
"Florduct" runs for telephone service.

Putting "Light" wires where you need them. "Florduct" with fittings is the answer to getting wires across the floor safely.

QUICK, hurry up safe method of getting wires across floors for electric or telephone service. Walk on "Florduct"—run hand trucks over "Florduct"—mop over "Florduct."

It is applied directly to the floor surface. Wires are laid in and capping snapped on. Eliminates hazards of open wiring.

"Florduct" is made in two sizes, designed just large enough for the wires with no extra space. Painted a neutral gray finish with complete line of fittings to match. Listed and approved by Underwriters Laboratories, Inc.

National Electric Products Corp.

Pittsburgh, Pennsylvania

Vocationalists

Where is the industry going to find its supply of young electrical engineers during the next several years? For the past three years the accelerated courses have furnished men to the military forces or to industry for specialized work and it will be years after the war before a new crop is available. All told, nearly a decade may elapse between the last unaccelerated graduating class and a new post-war lot.

In the meantime large numbers of men have been trained as war specialists in some phase of electrical and power engineering. Few if any of these men could qualify as electrical engineers, but it may be possible that their war training reinforced with a small amount of additional education could be adapted to peacetime occupation.

How far will the use of specialists with a limited short-term training go to change what has been the industry's requirements? How much of its need for electrical engineers actually requires men with a comprehensive basic education and how much can be accomplished just as well with men of narrower training?

It will be urged that these men of limited education are not electrical engineers but merely skilled workmen with vocational training. That is true, but in their work will they be any different from thousands of electrical engineers who all their lives work in a circumscribed occupation that requires skill more than it does an engineering degree?

The situation is further aggravated by the lack of employment during the depression period which drove large numbers of young electrical engineering graduates into other occupations. Because these young engineers were not absorbed by the electrical industry, the average age of its technical men is increasing and, in the utility industry in particular, it is getting near the limit. This will be relieved to some extent, of course, by the returning service men, but even so it will again be too high for the future welfare of the industry by the time our universities are again graduating engineers.

If it seems likely that a shortage of electrical engineers is going to cause a greater use of vocationally trained people, the next question is in what job classifications and with what training? The larger organizations can and probably will develop much of their own vocational training work, but the smaller companies will need assistance and no training program can be developed until job requirements have been defined.

The electrical industry was born in engineering and throughout its existence has placed much dependence for its development upon engineers. We have learned, however, during the war, to man so many jobs with people of far less training than we had been accustomed to demand previously that perhaps the war may teach us how to use engineering graduates to better advantage and not waste their talents on jobs that can be equally well handled by skilled men with merely vocational training.

There will still be plenty of opportunity for the able engineer, more in fact, as vocational trainees force him out of blind alleys and into occupations for which he was formally educated.

Live-Line Tool Care and Maintenance

Care of handles, fittings and ropes, storing of equipment, inspection, care in transit and on the job, training of workmen and operating rules are covered

J. A. MULKEY, Pacific Gas & Electric Co., Fresno, Calif.*

TOOLS REPRESENT a large investment where extensive live-line work is done and in order to make the work profitable and safe and to prolong the life of equipment, these tools must have proper care. Extent to which live-line tools are used is indicated by accurate records kept by one company for the entire year 1942, showing that more than 60,000 live-line jobs were safely accomplished. This work involved 148 crews, with an approximate average of 405 jobs per year per crew.

These jobs consisted of a variety of operations, such as the installation or removal of line-connection jumpers; installation or replacement of wood or steel crossarms, pole-top switches and switch units of various types including those that necessitated the deadending or splicing of line wires; the installation of pole-top riser extensions, conductor vibration dampers and aluminum armor reinforcing rods; replacement of suspension and pin type insulators and insulator pins; testing of insulators on lines, stations and plants to prove defects, leakage, etc.; cleaning of all types of insulators with various live-line angle cleaning fittings; and many miscellaneous jobs, including clearing radio interference. These activities involved voltages up to and including 220-kv.

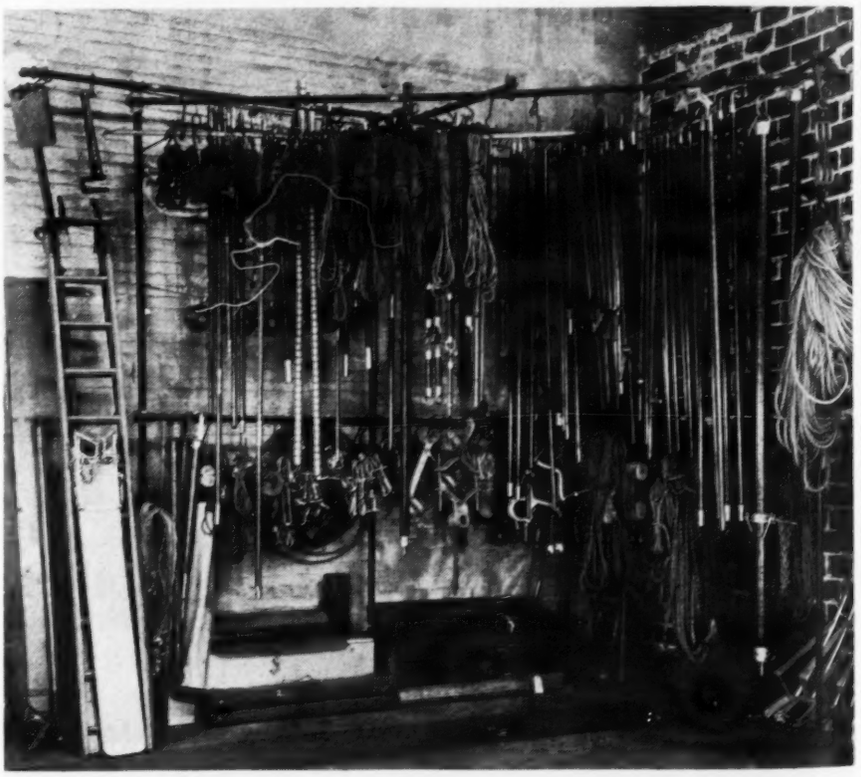
During the past 20 years the use of live-line tools has greatly increased. Each year has brought forth the development and manufacture of new tools to meet advancing requirements. From a mere half dozen tools this equipment has increased through the years to approximately eighty different items, a number sufficient to do any type of live-line job required safely and profitably, and on any voltage now being generated and transmitted over either steel or wood pole lines.

Care, Storage, Inspection

Proper care and use of this equipment may be rougly divided into the care of handles, metal fittings, and ropes; storage and regular inspection; and the instruction of workmen in safeguarding these expensive tools.

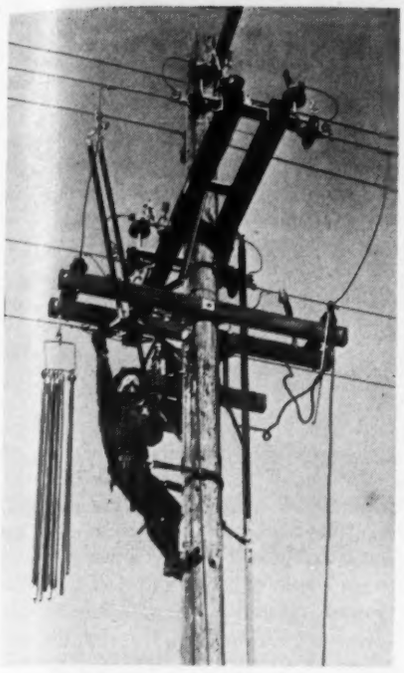
It required a number of years of experimentation with many different kinds of wood to find the proper material for good live-line tool handles. The handle is a very important part of a live-line tool, and it must have certain qualities. It must have necessary insulating value and be a material that will not warp over a period of time, either when being used or when stored. It must not splinter or split, and it must hold up through the process of the insulation preservative treatment.

A well-cared-for tool handle, if free from an unreasonable amount of foreign conductive substances, will



LIVE-LINE TOOLS when stored should be suspended vertically to prevent handles from warping. Ropes are coiled and suspended to permit free air circulation for drying

*General Supervisor, Live Line Maintenance, San Joaquin Division



METAL FRAME supports live-line tools while being sent up the pole, is equipped with rope sling and snaps convenient to operator while work is in progress.

give the operator a fair warning if he carelessly grasps the wooden handle too close to the energized conductor on which he is working. The severity of this warning, of course, will depend on the voltage being contacted, and will not, under normal conditions, be in the manner of a shock or jolt, but rather, a fuzzy or vibratory feeling or action of the tool handle in the grip of the workman's hand. However, if this vibration is felt when the tool is being used properly, it may be considered an indication that a state of deterioration exists and that the tool handle is unsafe.

Causes of Unsafe Handles

This unsafe condition may be due to loss of insulation preservative, absorption of moisture, or possibly to the fact that the varnish or lacquer needs to be renewed. A tool deteriorated in this manner is a serious hazard to the workman and apparatus, more through the possibility of causing a flash between phases due to short circuiting through the defective handle, than of receiving a shock, especially when working on lines of 4- to 30-kv. standard construction where spacings are more or less limited.

If the tool handle is only slightly scarred it can be put in satisfactory shape by wiping it thoroughly with a cloth saturated with a reliable grade of insulating lacquer thinner, and then applying one coat of good quality insulating lacquer or varnish. However, if the handle is badly marred, which usually occurs when it is used on steel structures, it is necessary to remove the old lacquer by scraping or sandpapering the handle smooth, and then apply three to five thin coats of varnish or lacquer. It is important that the varnish or lacquer be of a high-grade pliable insulating type, rather than the hard finish type, or one that might have a tendency to break down due to contact with the insulating preservatives, or when exposed to weather, heat or other damaging conditions.

Kept in First Class Condition

It has been found that when these tools are used on some types of work, such as the installation of conductor vibration dampers where the work is done from steel structures, it is necessary to clean and re-lacquer the handles as often as once a week. In all cases, however, it is vitally necessary to keep the handles in first-class condition, no matter how often they must be inspected or refinished.

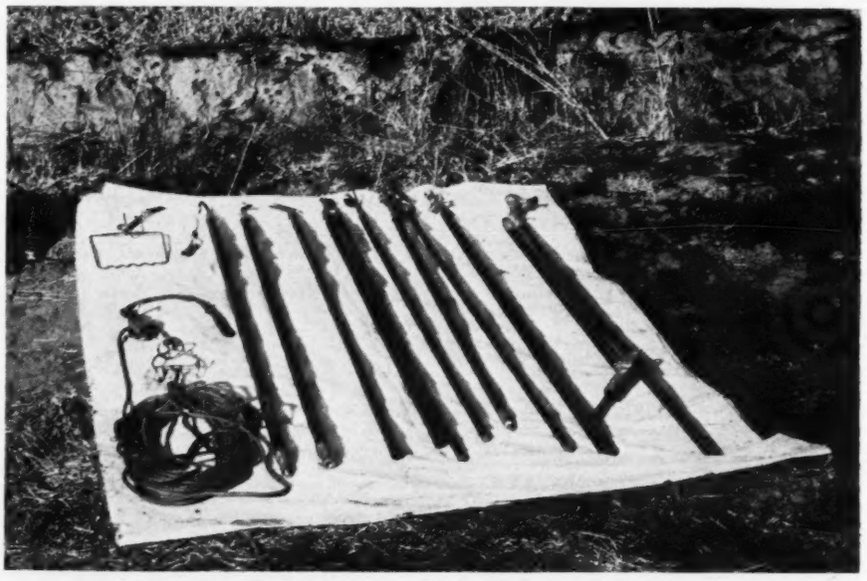
The question has been asked many times by workmen as to what handle lengths should be used on certain voltages. This can be answered by the explanation that if the tool handle, at the beginning, is constructed of the proper material and properly prepared and treated to withstand a test of 70,000 volts per ft., and followed, as time goes on, with proper care, and allows the operator to maintain safe clearance from the phases opposite the one being worked on, and clear of grounding obstructions, then the handle is of the proper length.

Metal Fittings and Ropes

The metallic heads or parts of live-line tools, in general, do not require as much attention as the insulated handles. It is important, however, that they be watched in order to keep the moving parts adjusted, clean and lubricated.

The right care of the specially treated ropes used in conjunction with live-line tools is imperative, since often the safety of the workmen and the success of the job depends on the strength and insulating value of the live-line rope. The insulation preservative used in some grades of live-line rope is mostly a moisture resistant preservative and has a tendency to accumulate dirt and other substances, particularly in war climates.

The life of the rope can be greatly prolonged if it is wiped with a dry cloth before being stored. If it has become badly soiled it can be successfully cleaned with a cloth slightly dampened with cleaning solvent. When the rope is stored in the tool room it should be removed from its container and suspended in coils,



WATERPROOF TARPAULIN spread at base of structure protects live-line tools from dirt and moisture while the job is in progress

Rules and Regulations for Use and Maintenance of Live-Line Tools

Penalty for Violation of Rules

RULE 1—District superintendents are to see that each foreman of crews is supplied with a copy of these rules and that they are obeyed. Anyone violating these rules will be subject to immediate dismissal.

Minimum Rules

RULE 2—These rules are minimum requirements. Any additional means of insuring safety that is necessary or advisable, in the opinion of the foreman of the crew doing the work, shall be employed.

New Tools

RULE 3—No newly developed tools are to be used on energized lines until they have been approved by the division superintendent and live-line supervisor.

Tool Inspection and Maintenance

RULE 4—All live-line tools must be inspected at least once every 6 mo. by the live-line maintenance supervisor and retreated if necessary. In addition, all live-line tools being used in each district or territory must be given a thorough inspection each month, by an appointed foreman, and if necessary, cleaned by use of sandpaper and revarnished with varnish recommended and furnished by the live-line maintenance supervisor.

Foreman Responsible

RULE 5—The foreman appointed to conduct inspections will be held responsible for the condition of all live-line tools used in the district or territory, as well as all fuse puller equipment. He must report his inspections to the district superintendent in writing with a copy of his report to the supervisor of live-line maintenance.

Care of Tools When Not in Use

RULE 6—When not in use all live-line tools must be kept in boxes or canvas bags which are supplied for this purpose.

Treated Ropes

RULE 7—All ropes such as hand lines, block lines, or guy lines used in connection with live-line work must be specially treated approved rope.

Qualification

RULE 8—Only qualified men are to be used in connection with live-line work which have been approved by the supervisor of live-line maintenance.

Responsibility and Authority for Decisions

RULE 9—The decision as to the practicability of the use of the equipment for a given piece of work shall rest with the foreman of the crew, and he will have authority to refuse to perform such work when, in his opinion a hazard is involved. The decision is subject to revision by the division superintendent only, in which case the work shall be performed in his presence.

On Lines Above 17 Kv.

RULE 10—Live-line tools must not be used on lines carrying in excess of 30 kv. unless permission is obtained in each case from the division superintendent or live-line supervisor.

On Switches

RULE 11—Such special work as the installation of air or oil switches or the replacing of defective switch units is prohibited without special permission in each case from the division superintendent or the live-line supervisor.

On Transmission Lines

RULE 12—Whenever it is necessary to work on de-energized transmission lines over an energized distribution circuit of 6 kv. or greater, it will be necessary to obtain permission from the division superintendent, and when such permission is granted it will be necessary for the man in charge of the work to see that the ground switches at the substations on each side of the line being worked on, are locked closed with a private lock where it is impossible to install the proper grounds in the field on the circuit on which the work is being done. After the circuit has been properly killed and grounded, the operators at both ends shall be notified by the dispatcher or the man doing the work that circuit.....out of the substation is being worked on and it is not to be reclosed in case it should trip out until the man in charge of the work has reported clear on the circuit, or circuits, involved.

General

RULE 13—When work is being done on a circuit above other circuits such as telephone, secondaries, or a lower distribution circuit, the lower circuits or circuits with which contact is possible must be removed and spread away from the pole being worked on or covered with approved standard line covers.

Substation Protection

RULE 14—Substations controlling energized distribution lines over which work is being done shall be notified to leave the line dead if the switch trips, until clearance is received from the crew working over that line.

Handling Energized Wires

RULE 15—When setting poles in live lines, all wires on the adjacent poles each way from the new pole being set must be securely tied in place with special pig-tail ropes supplied for that purpose to prevent the possibility of pins breaking or insulators stripping off from side strain when spreading wires. The wires must then be spread with guy ropes a sufficient distance to allow setting the new pole.

Use of Truck Derricks in Proximity to Energized Lines

RULE 16—A construction truck with the derrick raised shall not be transported to or placed adjacent to energized distribution or transmission lines that have insufficient ground clearance to clear derricks, except as follows: When necessary to set a pole in a line with less than 35-ft. ground clearance the truck shall be placed in its position to raise the pole before the derrick is erected. The energized line shall be spread and the derrick then raised. After the pole is set in the hole but before the wires that have been spread have been released, the truck may be moved forward a sufficient distance to permit the lowering of the derrick.

In Double Circuit Lines

RULE 17—Poles shall not be set in a double circuit distribution or transmission line nor any general reconstruction of double circuit lines without special permission of the division superintendent or live-line supervisor.

Pin Insulator Replacement

RULE 18—When using live-line tools for replacing pin-type insulators the conductors must be transferred from and to the insulators by the use of the live-line gin-pole.

Deadend Insulator Replacement

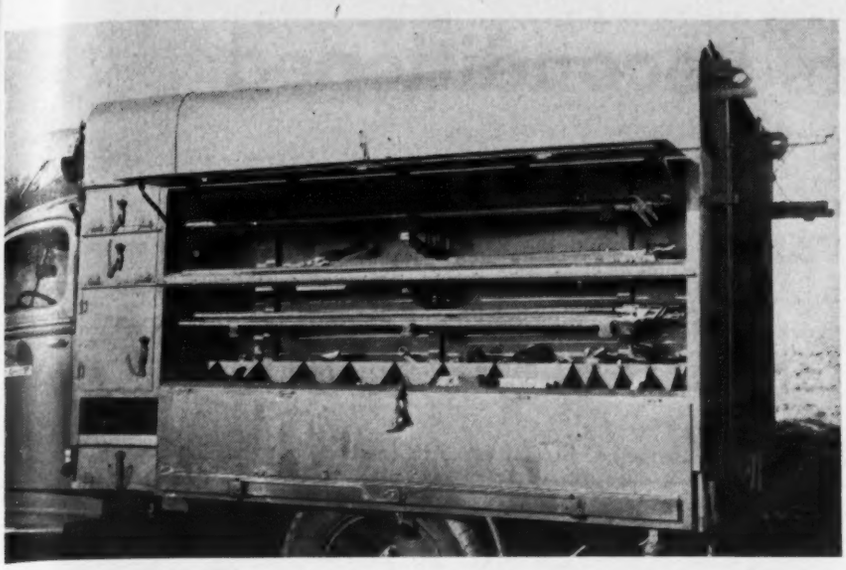
RULE 19—In changing deadend insulators, the fall lines of the blocks shall be passed over the crossarm or through a snatch-block so that the groundman shall in no case work under a "hot" line.

5-in. Blocks Required

RULE 20—Every live-line crew must be equipped with one set of three-sheave, 5-in. blocks and ½-in. treated rope which must be used on No. 2 wire and larger, when in the act of pulling line tensions for various purposes.

Personal Clearance for Conductors

RULE 21—When using live-line tools on lines carrying in excess of 750 volts, lineman must not work at any time closer than 18 in. to the energized line or energized metal part of the tool being used, and must at all times stay below the work being done.



SPECIALLY CONSTRUCTED metal tool box on live-line maintenance truck protects tools

clear of the floor, in a manner which will allow the circulation of air through it. This will aid in clearing it of any moisture it might have collected.

Storing and Transporting

Much care and thought should be given to the protection and storage of live-line equipment. Proper storeroom facilities should be provided, but it is even more important that the tools, ropes, etc., be protected against damage while being taken to and from the job, and while in use.

When stored in the tool room, tools should be removed from their containers and suspended in a vertical position as shown in an accompanying illustration, to prevent handle warping. There is an additional advantage in storing the tools in this way. In cases where more than one crew uses the tools, the men are given the opportunity to see that they are in good working condition, and can tell without loss of time just what tools are available.

Compartments Best for Carrying

In some instances crews transport tools to the job in compartments or pockets of waterproof canvas hung in a horizontal position from iron hooks in the beds of the trucks. This method of transportation is not as satisfactory as that of having each of the tools in its own canvas container, and all of them placed in a specially constructed waterproof metal box permanently attached to the truck, as standard assembly. Such a compartment is shown in one of the accompanying illustrations. The cost of replacing tool handles and canvas bags damaged from vibrating against the metal hooks in the first method mentioned will very soon prove to be a greater expense than the cost of installing the permanent metal boxes and purchasing the separate canvas tool bags.

Care on the Job

It is important that crews be supplied with medium weight waterproof tarpaulin, approximately 8x10 ft., to be spread at the base of the structure, as shown in one of the photographs, on which to lay the tools before they are sent up to the workmen. Live-line equipment must never be permitted to lie flat on the ground, even for a few seconds, since it might be exposed to moisture or a substance that would prove hazardous to the workman.

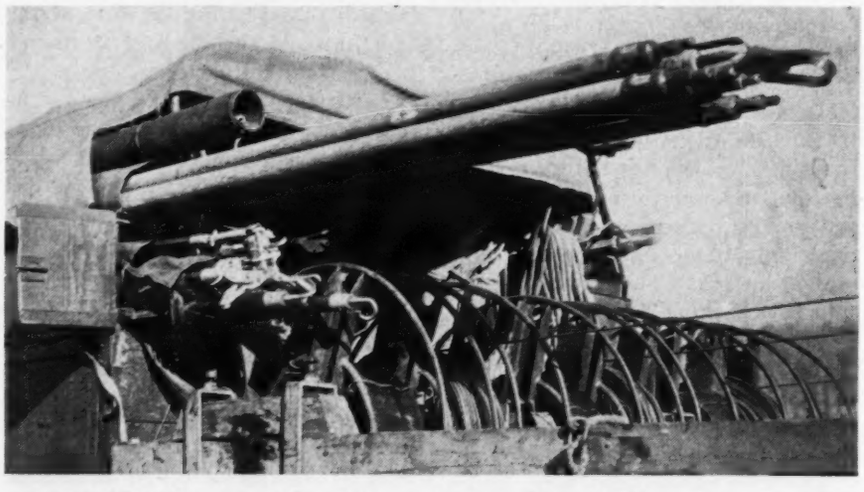
Some crews are supplied with folding tool racks that can be set up at the base of the structure to support the tools clear of the ground. Another item used to prevent tool damage, especially to prevent tools from falling from the top of a structure when not actually being used, is the metal tool frame shown, equipped with a rope sling and a snap, which is temporarily hung on a crossarm where the tools can be reached conveniently by the man who is using them.

Regular Inspection

It has been found that regular inspections are necessary to keep live-line equipment in order. These inspections are more satisfactory if made by one competent, experienced employee in each location, whose responsibility it is to see that these tools are kept in good shape. The inspections should cover all parts of the equipment.

In addition to regular inspections, the workmen must be instructed in the care and protection of the tools. The adoption of a set of brief, practical working rules, such as those here given, is necessary.

Experience has not only proved that live-line tools must be given good care, that lives and property depend on whether or not they are in safe condition, but it has also proved that the men who use the tools, and their supervisors, must be adequately and thoroughly trained. Successful live-line operations require well cared for tools—and competent men to use them.



LIVE-LINE TOOLS in individual canvas containers are stored in special compartment on heavy duty line construction truck for transportation to the job

Transformers Reconditioned in the Field

Corrosion caused by acid oil and condensation have been greatly reduced—Acidity of new oils progressing less rapidly than expected—Insulating condition improvement anticipated

E. B. CURDTS*, Superintendent of substation maintenance, Narragansett Electric Co., Providence, R. I.

RECONDITIONING older power transformers to improve their reliability and extend their life, at least during the war, is still an active problem. A few specific cases will be discussed, including a group of 15 non-conservator, water-cooled, single-phase units rated from 2,500 kva. to 6,250 kva. Twelve have 110-66/22/13-kv. windings, and three have 66/22-kv. windings. These units are about 28 years old and are in substations serving important war industries and other consumers.

Reconditioning was necessary during week ends. Acid oil was the primary cause of unreliability. The sludge resulting from this acid condition somewhat affected operating temperatures, but the acid condition itself caused chief concern. These units (free-breathing types) operate over frequent load or temperature cycles. This set the stage for trouble. The organic acids liberated from the oil, combining with the moisture breathed in and condensed on both ferrous and non-ferrous metals above the oil level, attacked these metals forming metallic salts. These salts in their dissolved state would run down the surface of the lower porcelain of some of the bushings before crystallization, and even form stalactites and stalagmites between the end of the porcelain and the bushing cables. Several 22-kv. and 13-kv. bushings have failed by flashing over at their lower end because of this in recent years. Radio interference resulted from this condition in one case before preventive measures were taken to correct the salt formation.

The salts would also form under the transformer covers, particularly in elevated bushing, manhole cover, and tap changer bosses, and either in their dissolved or crystal state would drop through the oil upon terminal boards, core and winding.

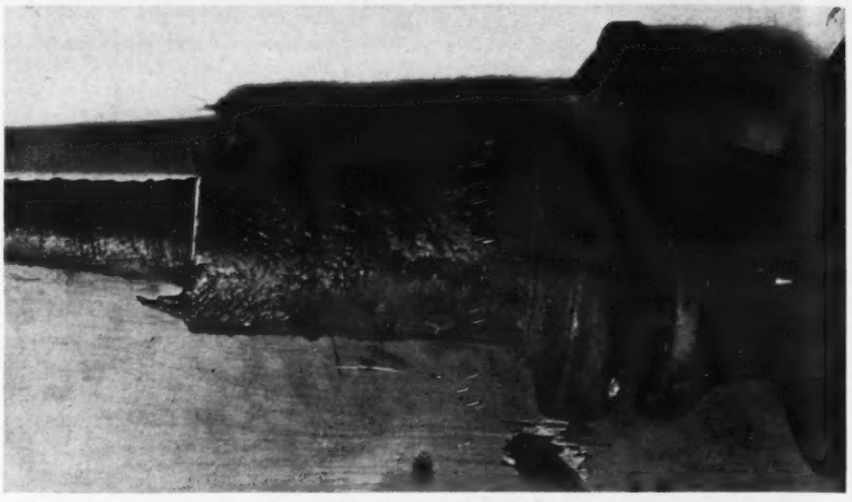


FIG. 1. Twenty-two-kv. transformer bushing had corrosion products deposited over the surfaces of the lower porcelain; stalactites and stalagmites formed as a result of electrostatic field. Stalagmites on cable not clearly evident. Clean areas under the mounting flange and over the lower porcelain shown were covered with corrosion products, which fell off in handling the bushing. In this case the mounting flange is a bronze casting and the cupric salts have a color that is bright green

Laboratory analyses of the oil in these transformers of course confirmed its condition as regards acidity, but showed no other serious defects. Rather than list voluminous statistical data obtained from these inspections, it can briefly be stated that they showed the oil in one case to have an acidity as high as 0.97 mg. KOH/g., although corrosion above the oil level was severe in some units having 0.2 oil; the dielectric strength in all cases was found to be better than 30 kv., and the oil power factors were found in the order of 0.5 percent.

The power factor of these oils was of course higher than that of new oil, but was not indicative since it could be reduced to approach the value of new oil by filtering out free sludge without changing its acidity. The neutralization number of the oil is not an entirely dependable guide as to whether corrosion will be serious in non-conservator type transformers since oil temperature, moisture, and time are all contributing factors.

Transformer power factors do not necessarily reveal, in this acid oil problem, what is going on either above or below the oil level, the losses caused by corrosion around the bushing lower porcelains and on terminal boards being hidden in the total losses of the windings. In some of the units, low side non-compounded bulk type bushings would show high hot-collar

*From a paper before The 1944 Doble Engineering Co. Client Conference at Boston, Mass.

losses due to the presence of corrosion products on the cable in the porcelain shells. In general, however, transformer power factors were in the order of one per cent with a few paths as high as 2 percent. Megger values corrected to 21 deg. C. were not low enough either to cause any concern.

Reconditioning

The reconditioning work planned included:

1. Flushing all transformer interior parts with cores in place and replacing the old oil with reconditioned or new inhibited oil.

2. Cleaning and applying acid resisting paint on the inside surfaces of covers and pockets and applying cork insulating paint to the outside surfaces of the covers.

3. Replacing felt with cork gaskets throughout, and either increasing the number of plain breathers or installing dehydrating breathers.

4. Installing modern bushings either with ground shields or with longer lower porcelains.

Since the outage time was limited to Saturdays and Sundays, and proper untanking facilities were not available in the vicinity, the core and coils could not be removed for thorough cleaning. Even had this been done, it would have been impossible to remove the acid oil trapped and soaked throughout the core and coils. The old oil was drained from a unit on a Saturday forenoon and the balance of the day spent in flushing and cleaning the core and coils. Fortunately, most of the units were large enough to permit men to work at the bottom of the tank during the final stages of cleaning. The flushing was started with old oil and finished with good oil. In a few cases the units were refilled with new inhibited oil, but in the main, reclaimed oil from our oil reconditioning plant was used. It is our opinion, which must be proven by time, that the old acid oils have developed some immunity to oxidation which, if true, places them in the class of the modern fortified or artificially inhibited oils.

During the oil change, all bushings with their adapter plates and manhole covers were removed to permit regasketing with cork and cleaning and painting all surfaces subjected to acid and condensation. Air pressure of about 15 psi. was applied in the space above the oil in these units prior to any reconditioning work in an effort to determine just how badly the various joints leaked. Old felt gaskets were found to provide very poor seals, and several non-compounded bulk type bushings were found with badly leaking top caps. Not all main cover felt gaskets have as yet been changed to cork due to the amount of work involved in lifting the heavy cast covers. Several paints have been tried over a period of several years on areas under the covers subjected to corrosion, but none so far have been found superior to General Electric No. 1201 Glyptal. Dehydrating breathers using silica gel have been installed on some of these units, and on some, the ordinary free-breathing type have been increased from two to four equally spaced at the outer edge of the main covers.

On some of the units modern bushings with ground sleeves have been installed to replace the obsolete bulk type having short lower porcelains. In others, negotiations are in progress with the transformer manufacturers to obtain bushings of modern design. In either case, these ground sleeves will be submerged in the oil.

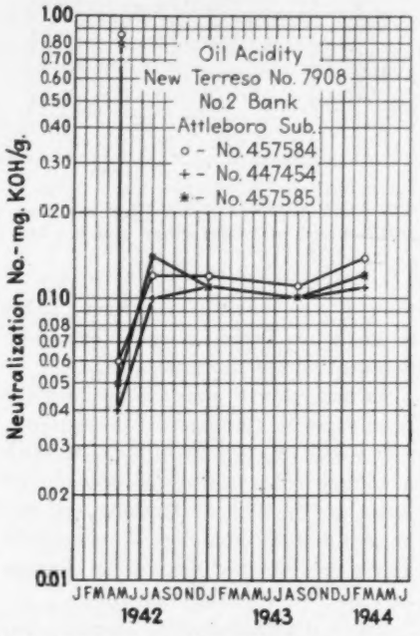


FIG. 2. Trend of oil acidity in a typical bank of three transformers after replacing the old acid oil with new inhibited oil in April, 1942. Samples of the new oil were taken after it had been filtered in the transformer for about 8 hr. in a 12-in. press. Circulation of new oil while filtering further cleansed core and coils, removing some previously inaccessible sludge. Acidity of the oil after circulation during filtering was of course higher than new oil, due to contamination with old oil left in core and coils. This is a rough measure of the thoroughness of preliminary cleaning. From April to July, 1942, natural circulation of the oil due to transformer loading flushed out more acid oil, especially in otherwise inaccessible oil ducts. Since then acidity was fairly constant

Three of the units are scheduled to be retired from service this year, and of the others, four have suffered winding failures and have been rewound since 1938. Consideration is being given to converting the twelve remaining units to gas filled or conservator types in the future.

Results Gratifying

In summarizing the work done on these units it can be said the results have been worth the effort and cost. Corrosion caused by acid oil and condensation has been greatly reduced, and the acidity of the new and reclaimed oils which have been in service in some cases for 1½ years is not rising as fast as was expected.

Another case in which the oil was the offender involved four 32/2.3-kv. 2500-kva. single-phase conservator type transformers.

Over a period of years, the 21-deg. C. megger values have lowered progressively until in the summer of 1943 they had reached values in the order of 75 megohms. The units were then power-factor-tested for the first time showing values in the order of 15 percent. The oil was analyzed also at that time and showed an acidity of 0.6 mg./KOH, a power factor of 8 percent and a dielectric strength of 30 kv. Next, the oil was filtered with no appreciable improvement in any of the test values. The oil was then drained to the top of the windings to permit an internal inspection which revealed the presence of very little sludge.

It was decided to provide new inhibited oil which was done after flushing the tank interior, core, and coils with old and new oil without removing the core and coils. No other reconditioning work was done, but immediately after the oil was changed, the 21-deg. C. megger values rose to the order of 1,500 megohms, and the power factors decreased to values in the order of 8 percent. This work was done last October, and we expect that both the megger and power factor values will improve as the old oil, which was left trapped and soaked in the coils, blends with the new oil.

Rectifiers and Converters Paralleled on Zinc Cell Lines

Problem of protection of rectifier against converter flashover and of converter against rectifier arc-back solved by comprehensive interlocking of breakers

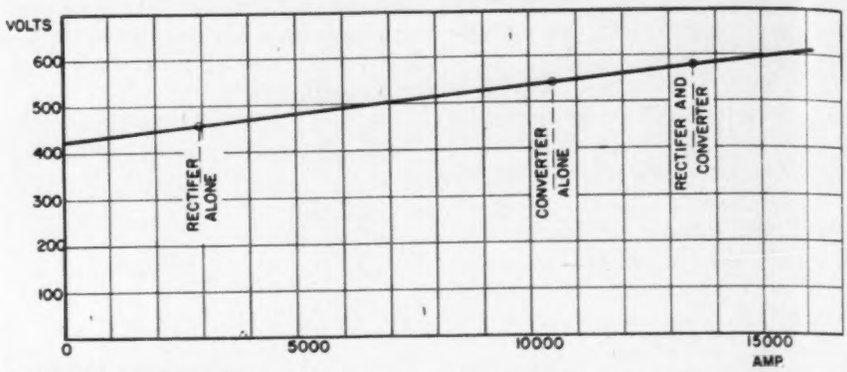
H. H. ZIELINSKI, Industrial Engineering Division, General Electric Company

OPERATION of synchronous converters and mercury arc rectifiers in parallel is not uncommon practice but it is believed that the teaming together of 10,000-amp. converters and 3,000-amp. rectifiers in the Anaconda zinc plant at Great Falls, Montana, is the first instance in this country involving such large units.

War requirements of zinc made increased production necessary at the plant. The existing nine converters were inadequate for the enlarged load. It was decided to provide the necessary additional capacity by means of rectifiers, despite misgivings in some quarters as to the wisdom of trying to parallel equipments of such size.

There are eight zinc lines in the plant, each one comprised of 156 cells in series fed by one converter. The ninth converter was installed as a spare but actually it was often used to increase production on one or another of the lines. The counter-electromotive force of each cell is approximately 2.72 volts, or about 425 volts for the entire cell line. The total resistance of the line is approximately 0.0115 ohm, although this resistance depends somewhat on the analysis of the electrolyte; i.e., on its acidity and its metallic impurities. The accompanying graph shows that the required voltage for 10,000-ampere cell-line current is 540 volts, while at 14,000 amperes more than 580 volts are required for overcoming the cemf and resistance drop. At 3,000 amperes, the cell-line voltage is oly 460 volts.

Variation of voltage is required to reduce the voltage when a number of cells are removed from the circuit for the purpose of stripping the deposited metal from the cathodes. Cells are removed by short circuiting them through a large copper bus bar dropped across the terminals.



VOLTAGE CHARACTERISTIC of zinc line with 156 cells in series under operation with rectifier and converter alone and the two in parallel

In accordance with the operational requirements the rectifiers were provided with phase control for obtaining a voltage reduction of 25 percent. In order to limit their tendency to arc back when subjected to considerable phase retardation, the anode circuits include commutating reactors.

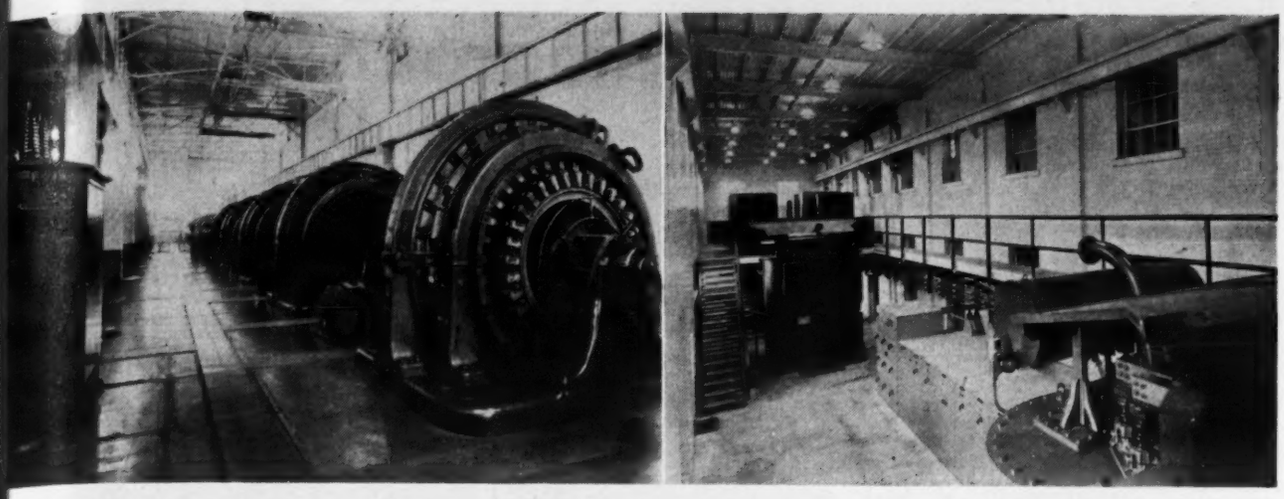
Since it was desired to operate two rectifiers from one transformer without creating any interference in the operation of two cell lines, anode breakers were used. Thus, in case of an arc-back on one of the two rectifiers the other cell line is not disturbed, except for a temporary increase in the rectifier voltage and the rectifier load, due to the regulation of the transformer.

The a.c. overcurrent relay of the converter will open the supply breaker in case of a flashover, while at the same time, the d.c. breakers will open on reverse current. In order to eliminate the possibility of the rectifier feeding into the flashover of the converter, the rectifier cathode breaker was interlocked with the a.c. overcurrent relay of its paralleled converter so that the cathode breaker also opens in the case of a flashover.

An arc-back on the rectifier trips one or more poles of the anode breaker, and an interlock on this breaker is provided for tripping the cathode breaker immediately thereafter in order to avoid operating the rectifier with only a part of its anodes. This momentarily throws the rectifier load on the converter and results in the opening of its d.c. breakers.

It is, therefore, impossible for the converter to feed into an arc-back of the rectifier just as it is impossible for the rectifier to feed into a flashover of its paralleled converter.

In this connection, it should be noted that the two conversion equipments are actually paralleled at the cell line, which is relatively far removed from the conversion equipments. Therefore, some reactance remains in the circuit between the converter and rectifier which limits transient currents between the two conver-



EIGHT OF THESE NINE 10,000-amp. synchronous converters are each paralleled with a 3,000-amp. rectifier. Rectifiers are installed in two groups of four (right) fed in pairs from four transformers. Rectifiers in background

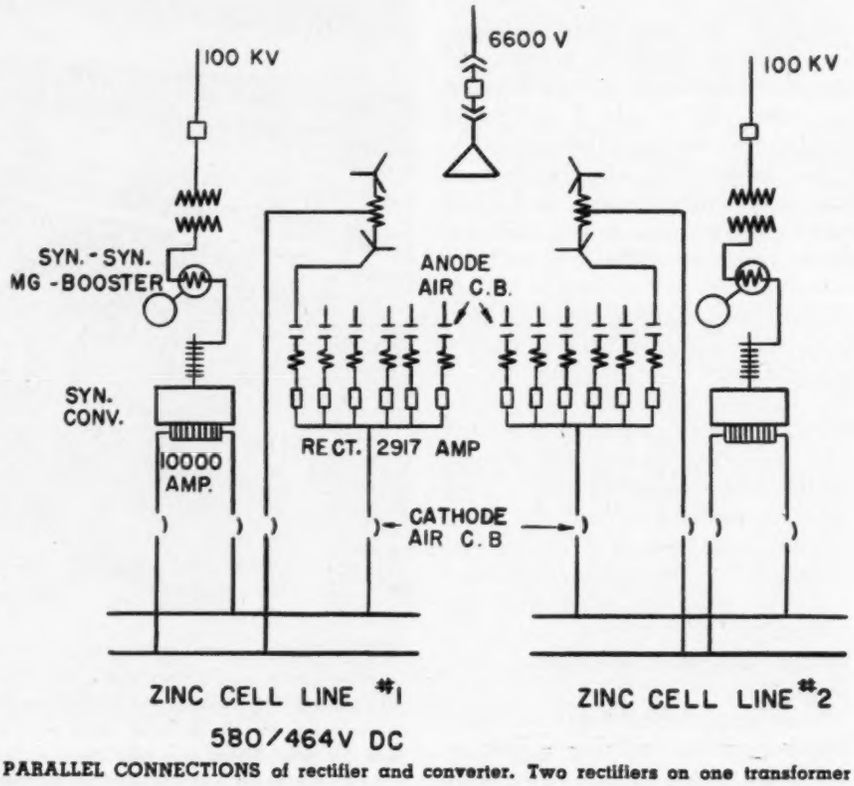
sion equipments. Experience during parallel operation has shown that neither the flashover of the converter nor the arc-back on the rectifier involves any additional hazard for the equipment, although the flashover, if severe enough, may damage the armature of the converter.

An automatic current regulator is provided for each rectifier which not only holds the rectifier current to a constant preset value, but also simplifies the operation during a circuit interruption. An interlock on the cathode breaker forces the regulator into the minimum current (voltage) position when this breaker trips. This position corresponds to about 435 volts which is just slightly above the cemf of the cell line. If the regulator should not be returned to the low position when the rectifier is reconnected to the cell line, it would temporarily carry a large overload and its cathode breaker trip out again.

Because of the automatic action of the regulator, the operator is able to throw the rectifier back on the cell line immediately. The regulator will then bring the current up to the rated rectifier capacity, corresponding to about 460 volts, while the operator can confine his attention to the starting of the converter and to adjusting its voltage to the point where rated output is obtained. While the converter is so being brought up to full load, the voltage of the rectifier is coincidently increased by its regulator from 460 to 580 volts, when both equipments in parallel carry the full current of about 13,000 amperes.

Interruptions of the current supply to a zinc cell line not only cause a proportionate loss of production, but also allow the cemf of the cells to turn back into solution the zinc deposited on the cathodes, as long as the impressed d.c. voltage does not exceed the cemf. The automatic regulation of the rectifier is therefore especially important in this case, inasmuch as it shortens the time required for reconnecting the d.c. supply of the rectifier to the cell line and also for bringing both paralleled equipments up to full load.

In the actual practice of the cell-line operation, the parallel operation of a rectifier and a synchronous converter has been without any particular operating problem. This is emphasized because of the often-expressed fear that rotating and static conversion equipments, having somewhat different characteristics, could not be paralleled because they would not share the load in proportion to the rating of the individual equipment. Actually, the division of the load between the two equipments is quite simply accomplished by the proper voltage (current) regulation of each equipment.



PARALLEL CONNECTIONS of rectifier and converter. Two rectifiers on one transformer

Turbine Casings Reground to Stop Gasket Leaks

Seattle rigs grinder to resurface in place the main joint between upper and lower halves of three turbines which had blown gaskets after many years of heavy loading

W. G. ELDER, Electrical Machinist, Department of Lighting, Seattle, Wash.

REPAIR, in place, of two steam condensing turbines, driving generators of 7,500-kw. and 10,000-kw. respectively, was recently completed at the Lake Union steam plant of the Department of Lighting, City of Seattle, Washington. The results in stopping gasket leakage of the casings have proved so successful that work has commenced on a third turbo-generator of 12,500-kw.

This steam plant is used at present as an emergency source of power to supplement the main hydroelectric power plants at Cedar Falls and the world famous Skagit River development.

Gasket Leakage

During the years these turbines have been in operation, a matter of almost a quarter of a century, they have seen long periods of continuous satisfactory service, sometimes at a considerable overload. However, it was apparent that the years had at last taken their toll due to the daily extreme variation of the load with resultant heating and cooling of the turbine surfaces. Gaskets began to blow out of the main joint between the upper and lower halves of the turbine case that had originally been metal to metal. There was serious leakage between expansion stages due to portions of the gasket material having been blown through into the blading. These resulted in decreased efficiency and attendant discomforts due to condensation of escaping steam into the powerhouse. This leakage was caused by the warpage of the turbine cases themselves.

Something radical had to be done. Gasket patching resulting in different thicknesses was laborious and inefficient. The usual course would have been to dismantle completely the turbine from the condenser and foundation supports. This would have involved the removal of several hundred large bolts and the sending of dismembered pieces out to a machine shop to be resurfaced on a planer. Owing to the pressure of war work on the West Coast, no planer of sufficient size was available in Seattle.

At a conference between Mr. E. R. Hoffman, superintendent of City Light; Mr. George Meagher, shop superintendent, and Mr. Henry Ragge, chief steam engineer, the shop superintendent suggested a method of grinding the warped gasket surfaces in place by means of a surface grinder.

The writer was instructed to work out the details and carry the job through to completion. City Light is fortunate in having a modern machine shop and competent staff of machinists under C. O. Graham, a veteran employee with over thirty years service, and it was decided to make full use of the excellent facilities available.

It was decided to grind the gasket surfaces of the turbines and covers by means of a grinder moving from end

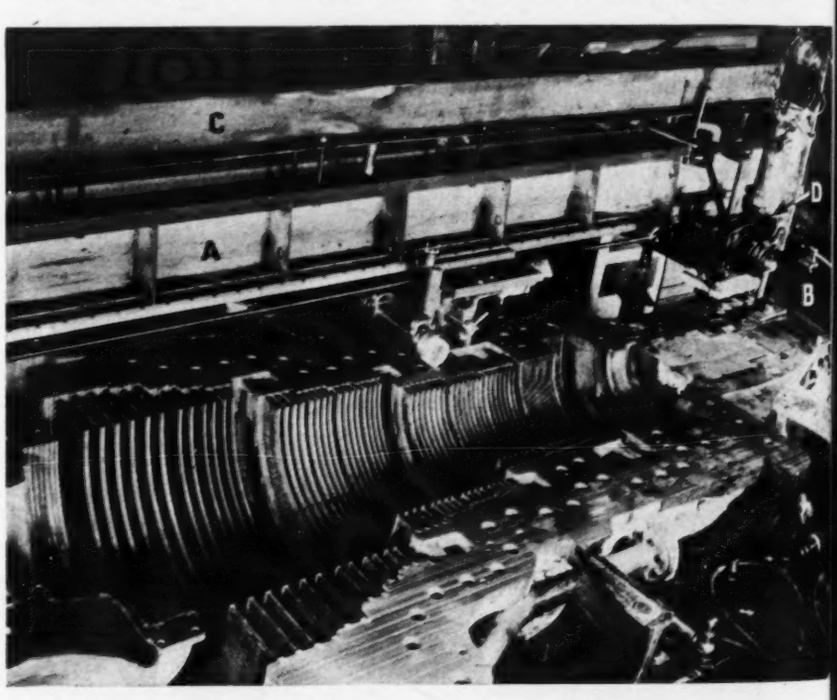


FIG. 1—Grinder assembled in position over turbine. The grinder traveled longitudinally by means of a screw feed along the 20-ft. main beam. The width of the cut (1½ in.) was secured by sliding the beam transversely as occasion demanded over the two end support I-beams. Suitable stops were provided to govern the width of the feed each time the main beam was slid over, and a block and tackle on each end was found to be an easier method than manual prying with a bar

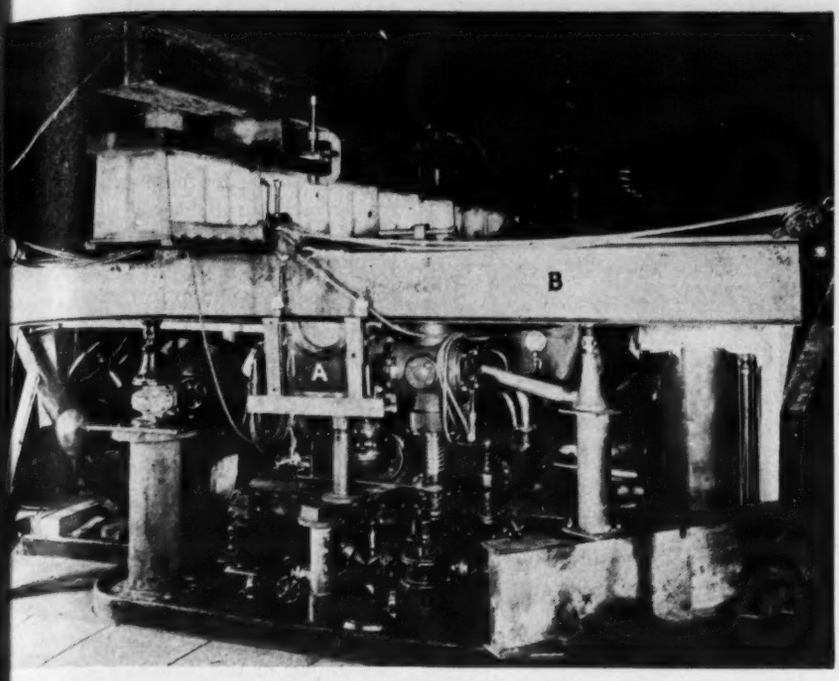


FIG. 2—Crossbeam assembly support on bottom half of turbine. Beams are planed on top and bottom. Four jackscrews were used to correct deflection of the beams. Accurate level and micrometer adjustment for leveling horizontal

to end of a beam (Fig. 1 "A") about 20 ft. long overlying the entire length of the turbine and supported on each end by cross members (12-in. planed I-beams, twelve feet long, Fig. 1 "B") resting on and clamped to the flat bearing surfaces at the extreme ends of the turbines themselves (Fig. 2 "A").

The feed motor (Fig. 1 "D") employed to move the stone along the main beam was of the adjustable-speed type with a speed variation from 200 to 3,000 rpm. This permitted a slow feed for heavy roughing cuts or a quick advance over the work. (See Fig. 5 for details of feed).

A hand operated feed was also provided independently of the motor operated feed. It was useful in setting up before the necessary connections had been made to permit operation of the motor feed.

The 18-ft.-span main beam was designed and fabricated in the City Light steel shop. The long span caused an 0.007-in. deflection (partly due to the weight of the sliding grinding support carriage) which had to be compensated, otherwise the ground turbine surface would be an exact duplicate of any idiosyncrasy of the beam itself. This deflection was corrected by means of a truss above the main beam (Fig. 1 "C") and by six tie bolts, three on each side. The truss and tie bolts pulled the main beam up. When grinding of the turbine surfaces and covers was completed the variation from the flat was less than two one-thousandths of an inch. The basis for the main beam was a 12-in. I-beam, 20 ft. long, strengthened by a 12-in. x 2½-in. x 20-ft. channel iron welded to the top edge up and ½-in. x 14-in. x 20-ft. plate welded to the bottom. To make material for the ways to carry the grinding carriage, two pieces of 1¼ in. x 2 in. x 20-ft. iron were welded to the bottom of the plate. The whole structure was strengthened every two feet by web stiffeners securely welded in. This additional strengthening was no more than was absolutely necessary as the grinding set up a resonance cycle that was distinctly noticeable on roughing cuts but not on the light finishing cuts.

The main beam weighed 2,700 pounds and after fabrication it was placed in an electric furnace for twelve hours and brought to a cherry red heat to relieve welding strains. Upon cooling the V-ways were planed to fit the sliding carriage mounting the grinding arbor (Fig. 4 "A"). An adjustable gib was used to compensate for wear.

Accuracy of the final cut over the flat gasket surface of the turbine depended on three important considerations. First, that the main grinding beam should be absolutely straight with no deflection. Second, that the two end support beams be exactly level in the same average plane as the face of the turbine to be resurfaced; and, third, that the main beam above referred to be parallel to the same plane as the lengthwise axis of the turbine.

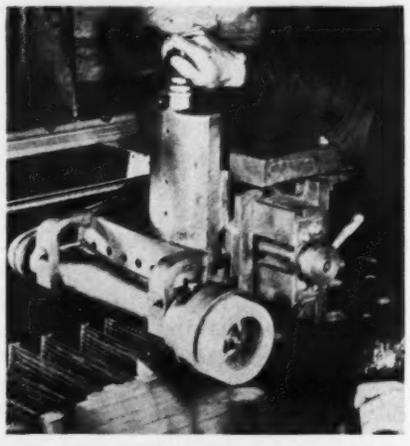


FIG. 3—Grinding was done with a Norton Cup Wheel No. 3836H8BE, 5-in. diameter, 2¾ inches wide, suitable for cast iron, mounted on a specially constructed arbor with Timken bearings and leather dust seals running at 3440 rpm.

FIG. 4—Sliding carriage and grinding arbor (rear view): 1 hp. motor driving through two ⅝-in. V-belts. Feed nut "B" is a split cast iron block mounted on carriages

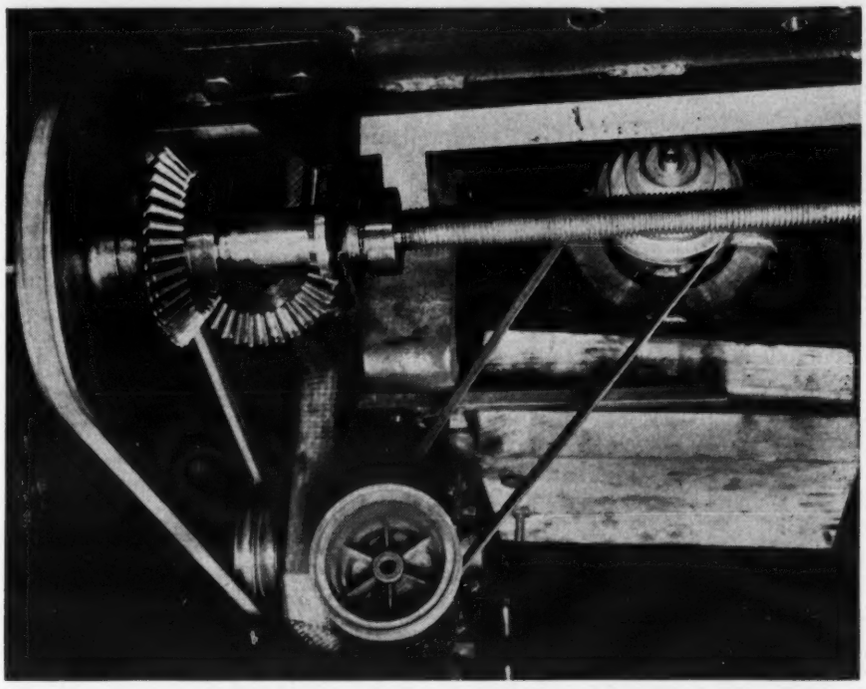


FIG. 5—Adjustable-speed feed assembly: 20/1 worm-gear reducer plus V-belt drive of 1-in. 8-thread lead screw 18 ft. long supported by bearings on each end. Movable splined key made change-over from hand to motor feed

This may be visualized as a taut piano wire stretched from end to end of the turbine, through, and centralized with the main bearings. The main beam was adjusted parallel to this axis by raising or lowering the two end cross beams on which it rested by means of shims under them where they rested on flat end turbine bearing surfaces.

The two end support beams were leveled in the same average plane as the turbine surfaces to be reground by moving the main beam over them from one side of the turbine to the other while checking the distances with an inside micrometer from its planed under surface down to the turbine face. Due to the warpage of the turbine surfaces a mean average of readings was taken to assure perfect alignment. When this was secured the two end support beams were securely clamped down to the bearing faces. A witness cut was then taken to insure accuracy before the commitment of rough grinding.

Grinding the turbine case covers necessitated additional preparations. First, the cover was turned over with the face side up to be resurfaced. It was decided to use one of the end support beams still in place from the previous grinding of the lower half as a support for the main grinding beam in grinding the cover. The cover was then moved up in juxtaposition to the fixed bottom half of the machine already surfaced about four feet away from the cross support beam fastened to the extreme end flat bearing surface of the turbine proper. This arrangement made a solid support for one of the main beam supports (Fig. 6). The main beam was placed on top of the two cross beams and the whole assembly accurately leveled. By use of inside micrometer from the planed surface of the main beam, the cover was leveled parallel to the above beam.

Accurate setup of the cover was obtained by means of two pedestals, one on either side of the low pressure end that mounted a type of screw jack incorporated in their construction and in front the case was shimmed up to the correct height from a pedestal fastened to the cement floor. This method of support employed three-point suspension, one of the points being stable and definitely fixed. The other two were solid, but adjustable vertically by means of a fine screw-thread. The cover was set on its own supports from the floor independent of the pedestals supporting the grinding apparatus. The removal of one cover and the insertion of another did not affect the pedestals and grinding beam setup. This might have happened if a common base had been employed to support both the pedestal and turbine case as the latter weighed about seven tons.

There was a temperature variation

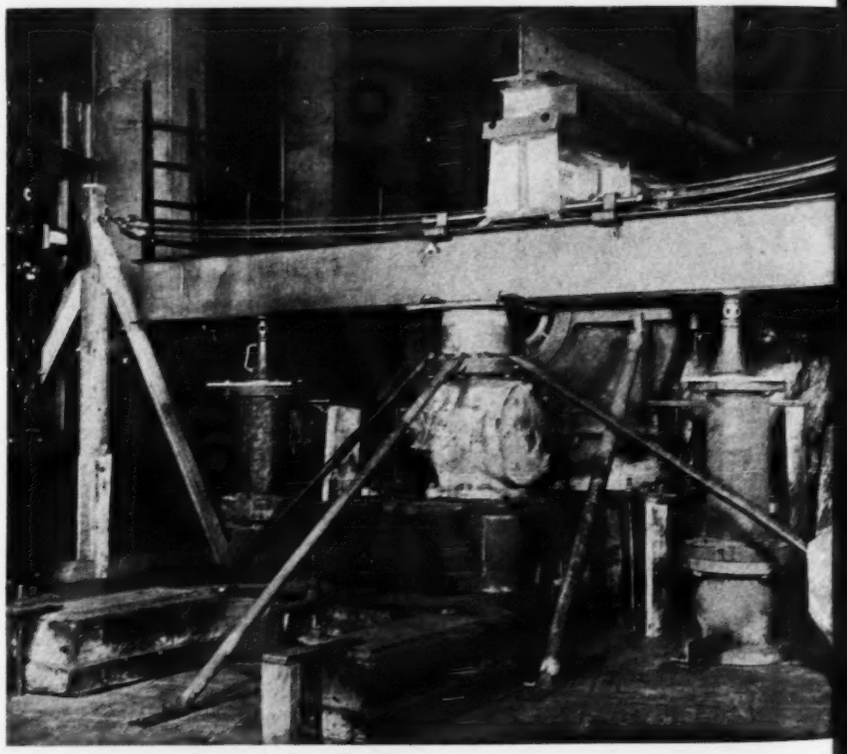


FIG. 6—Cross-beam pedestal support for grinding cover. Temporary pedestal out of heavy motor generator base fastened with tamp-pin to the cement floor and by bolting down an old butterfly valve with a pedestal on top of it. These were leveled and the other cross beam was placed on top of this assembly and securely clamped into place. Several crowfoot braces were used to steady it and fastened to the cement floor

of approximately 25 deg. during progress of this work. There appeared to be very little change in the general setup, but the 20-ft. main grinding beam showed slight changes involving several thousands of an inch that had to be compensated for by some adjustments at infrequent intervals.

The average time involved in the actual grinding was about 200 hours to each turbine. The amount of metal removed from each half was approximately 45 thousandths of an inch. Roughing cuts removed about 20 thousandths of metal per cut. It was necessary to compensate for the removal of this metal by inserting a metal gasket cut to a pattern of the turbine surface. Special phosphor bronze plates of the same thickness blocked off the escape of steam through the dummy piston. These plates were cut the same shape as the insert dummy rings (cross section) and were dovetailed into the sheet metal gasket to make a steam-tight joint. They became an integral part of the metal gasket covering the entire finished surface of the turbine.

Emery Control

Control of flying cast iron particles and emery dust was of no mean importance. All exposed bearing surfaces were thoroughly covered and cardboard stoppers were fitted over bearing oil reservoirs. All oil pipes were stoppered. A large commercial vacuum cleaner removed surplus emery and cast iron dust during grinding operations. In addition, a movable shield, suitable for grinding inspection, was fitted around the grinding wheel itself, with a vacuum attachment to collect flying particles. A canvas tent over the entire machine with an air conditioning unit took care of the dust from grinding. Upon completion of resurfacing, the entire surface of the turbines inside and out were subjected to a thorough cleaning by vacuum cleaner and compressed air jet to remove foreign particles. Oil feed pipes to the bearings were disconnected and washed out with mineral spirits and, finally, a coat of oil-proof insulating varnish was applied to inside surfaces of the governor and bearing oil reservoirs to stabilize any particles adhering to their surfaces. The turbine oil circulating to the bearings was purified in a centrifuge. Outside surfaces of the machine and condenser units were repainted.

Wood Trusses For Alley Distribution

Alley arm construction replaced by wood trusses spanning a 40-ft. roadway including railroad spur tracks

SAM W. DAVIS,* Southwestern Public Service Co., Amarillo, Tex.

RECENTLY this company was faced with a problem in the rebuilding of overhead distribution lines in an alley in the business district of Amarillo, Tex. The distribution lines in this alley had been supported on single poles and alley arms. Because of the number of large conductors to be supported, this type of construction was inadequate in strength to withstand an ice loading condition. Also because of the railroad spur tracks, it was necessary to use supporting structures having a span of 37 ft. over these tracks. Since steel was not available it was necessary to

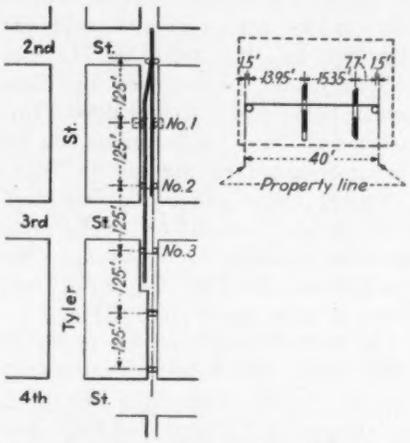


FIG. 1 Forty-ft. alley with railroad spur tracks necessitated three 37-ft. wood trusses

FIG. 2 One of three flat top Pratt trusses has been erected and the second, assembled on the ground, is being raised by gin pole and truck winch line

*District Engineer.

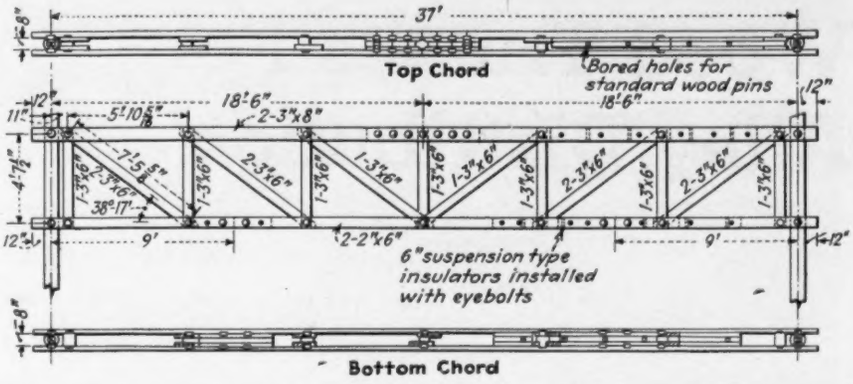


FIG. 3 Six-panel truss made of southern yellow pine members computed for maximum stress of 282 psi. and minimum safety factor of 3.12

design wood trusses for the three structures involved. These trusses had to be designed with sufficient strength to withstand the stresses which would be imposed on them under heavy loading conditions. This proved to be a fairly simple job by using design data supplied by TECO (Timber Engineering Co., Washington, D. C., a subsidiary of National Lumber Manufacturers Assoc.) We picked out the Flat Top Pratt type truss as most applicable. (Fig. 2)

It was decided that the depth of this truss should be approximately 4½ ft. in order to use the top chord to support the primary and the bottom chord to support the secondary lines, and maintain proper separation.

The number of panels was found by dividing the truss length into two equal parts and then dividing each half into a number of equal panels. The number or size of these panels must be such that the diagonal member makes an angle of approximately 45 deg. with the bottom and top chords. This gave six panels.

The stresses were computed for No. 4/0 power conductors and No. 6 control wires. The No. 4/0 with ½-in. ice weighs 1.48 pounds per foot and the No. 6 weighs 0.627. Thus the panel point loads were these for 125-ft. spacing between each of the end and the middle structures:

Top
Chord . $3 \times 125 \times 1.48 = 555$ lb.

Bottom
Chord . $4 \times 125 \times 1.48 = 740$
$2 \times 125 \times 0.67 = 155$
2 men x 200 = 400

Total 1,850

This load, for simplification of calculations, was assumed concentrated at the center of the truss, realizing, however, that the resulting values of stresses would be greater than with the load approximately concentrated at the ends. The maximum stress of 11,100 pounds fell in the adjoining top chord member. The two 3 x 8-inch southern pine timbers (surfaced four sides) thus have a unit stress of 281.9 psi. and afford (with 880 psi. allowable) a minimum factor of safety of 3.12. Other truss members were chosen as indicated in Fig. 3. All were pressure-treated with 8 pounds of creosote retention.

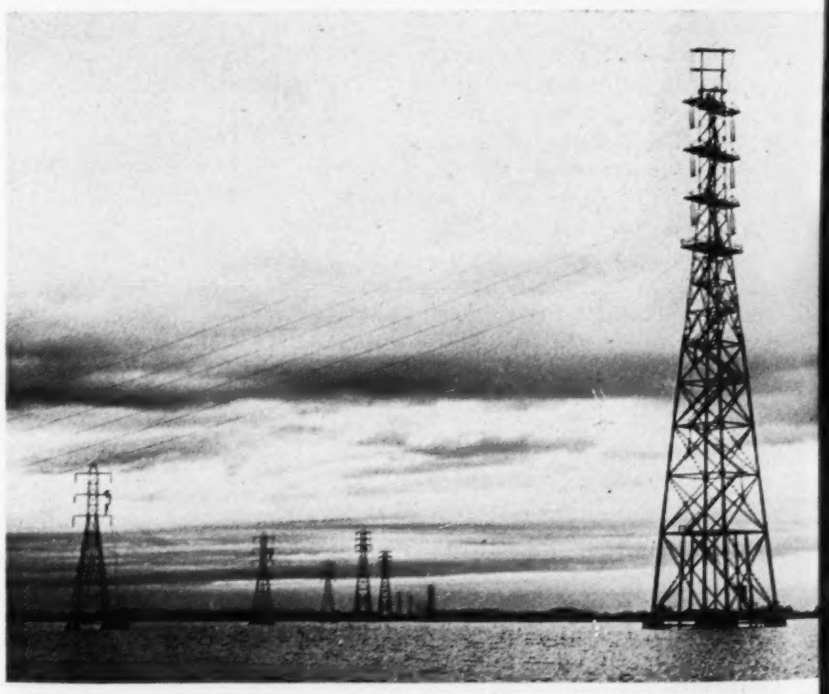
A main feature of these trusses was the use of 86 of the 4-in. split ring timber connectors to distribute stresses in joints over a greater area, thus greatly increasing the strength of the structure at joints, and preventing splitting around bolts.

Replace Span Over 110-Kv. Lines

Two feasible solutions presented themselves to the problem of replacing conductors in a span of 220-kv. lines that crossed over a 110-kv. steel tower line. Pacific Gas & Electric Co. chose the method shown. Two 35-ft. poles were placed on top of the 282-ft. tower carrying the conductors of the 220-kv. lines to be replaced and one circuit of the 110-kv. line was looped over this tower so that it could be energized while the work was in progress. The other 110-kv. line could be spared and was lowered into the body of water shown.

The "shoe-fly" over the 220-kv. line carried the 110-kv. circuit from the first high tower of that circuit seen in the background, up over the 220-kv. tower and to a dead-end tower in the 110-kv. line directly back of the point where the photograph was taken, with spans of approximately 2,500 ft. and 1,000 ft. respectively. The alternate method would have been to drive piling and erect a 100-ft. bridge structure over the 110-kv. line.

When the 220-kv. span was installed some years ago these towers were all on dry land but the whole region is now flooded and conductor replacement as all work had to be done from boats and barges.



110-KV. LINE is placed on temporary 35-ft. poles on 282-ft. tower on right while 220-kv. conductors in crossing span are replaced. Towers were originally on dry land

Buses Sectionalized By Compact Switch

3,000 ampere switch designed to fit an existing 125/250-volt, d.c. copper bus of channel section—rotating type, opens circuit at each end of blades—revising arrangement of bus system and providing considerable saving in copper

H. W. HEALD, Electrical-Mechanical Department, Frederic R. Harris, Inc., New York

SECTIONALIZING of an electrical bus in a switchboard structure is usually not too difficult to arrange if it is accomplished as a part of the original design. However, when it becomes necessary to effect a bus sectionalization after the switchgear structure has been fabricated and installed, it then becomes a problem of considerable concern.

To meet a particular war-time requirement, a 250/125-volt direct-current bus structure became the subject of such a project. The bus as originally installed was designed to serve three 600-kw., 250/125-volt, three-wire d.c. motor-generator units.

A copper bus of channel section was originally installed on a basis of 3,000 amp., for each of the outside positive and negative legs and the neutral at 50 percent of this capacity. The switchboard manufacturer also built the bus structure with an upper and lower bus section and paralleled these sections with solid bar copper straps.

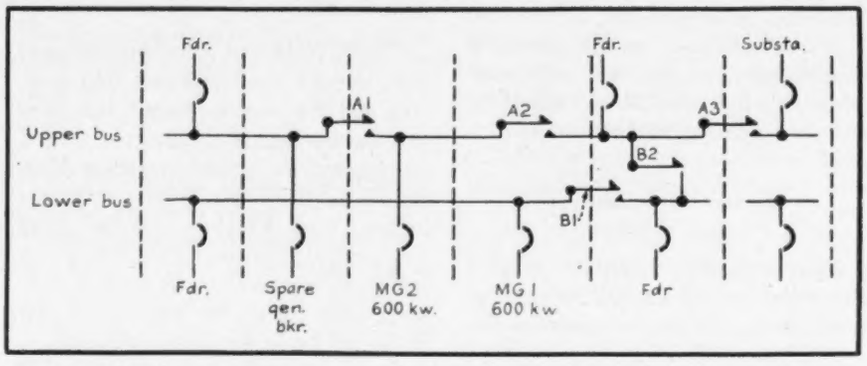


FIG. 2—Single-line diagram of bus and switch arrangement for six-unit switchboard

This arrangement made a very compact assembly, but also made it either impossible or difficult to install as many standard type of three-pole, 3,000-amp. knife switches in the rear of the compartment structure as would be required to serve as sectionalizing devices. To install switches of a proper size, together with either connecting cables or bar copper extensions for each sectionalizing point, would make a hazardous congestion of such an arrangement.

In the final arrangement of the switchboard bus to meet the specific war-time switching requirement, the original installation of three 600-kw. generators was reduced to two units and a feeder tie from another substation was connected to the board.

The design of a new type of bus-

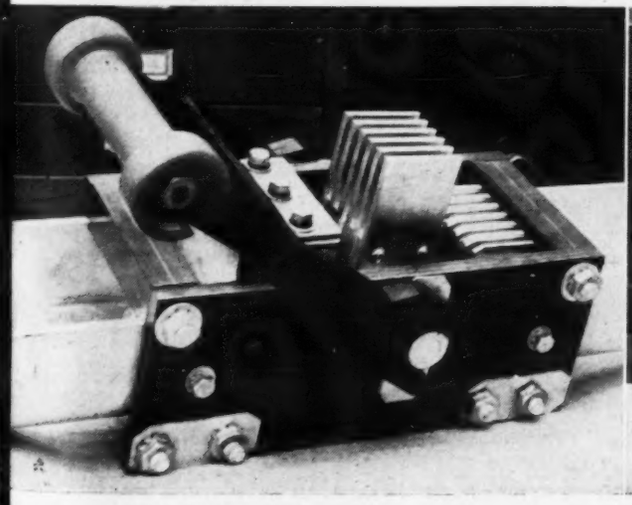


FIG. 1—Bus-section switch in open position.

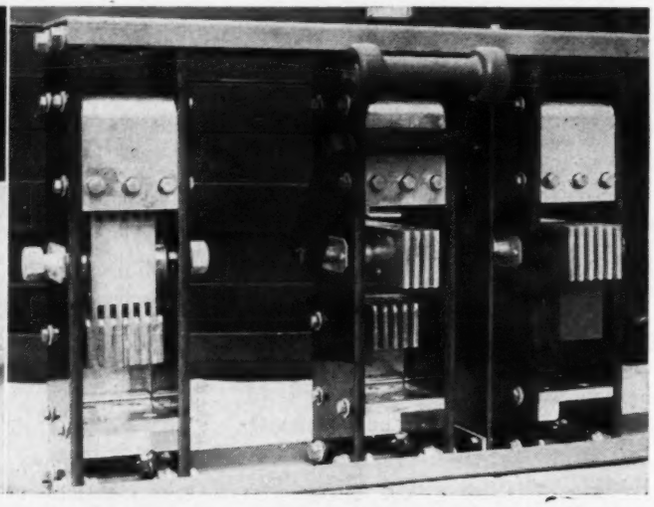


FIG. 3—Bus-tie switches used between upper and lower buses

sectionalizing switch was considered which would require no bus copper or cable extensions and which would occupy a minimum of space. The final approved design was a bus-sectionalizing switch which is illustrated in Fig. 1.

This type of switch opens the bus circuit at each end of the blades as the blade assembly is attached to and revolves with a center shaft by means of a hub plate which is welded to the shaft. The hub plate becomes also the center separator of the blade assembly and all blades and separator are then tied to it by means of four $\frac{3}{16}$-in. diameter steel rod rivets. Two of these rivets can be seen in Fig. 1.

A special type of switch operating handle was also designed and made removable to have it serve each of the bus-sectionalizing and tie units.

Revised Arrangement

The single-line diagram Fig. 2 shows the revised bus system arrangement. Sectionalizing switches are designated A1, A2, A3 and B1.

The revised bus system arrangement also required a bus-tie switch, B2, between the upper and lower buses and this was accomplished by using a similar type of switch as was used for the horizontal bus but mounted in a manner shown in Fig. 3. Connections to the upper and lower bus structures from these switches was then made by bus copper bars.

It will thus be seen that the use of this type of sectionalizing and tie switch made a considerable saving in cable or bus copper possible and the insertion of a sectionalizing device in the line of the bus structure, a comparatively easy procedure.

Buses to be connected must be "dead" before the sectionalizing or bus-tie switches are closed or opened. To prevent an opened bus-sectionalizing switch being accidently closed, a stop block made of a solid piece of maple was provided for each assembly.

All current-carrying contact surfaces of the switch blades and jaws and the block in contact with the channel is silverplated. All hardware is of steel, cadmium plated. The switch side rail support plates and the square spacer rods are made of a high strength, laminated phenolic insulating material.

Commercial Cooking Case History

Continuous, interested concern with customer's requirements as business grows results in consistent additions of load

H. M. KEMMER*, Appalachian Electric Power Co., Huntington, W. Va.

CONNECTED load increased 600 percent, energy use increased 245 percent and revenue increased 105 percent are the figures of nine-year record of commercial electric cooking load growth in Bailey's Cafeteria at Huntington, West Virginia. Maybe other commercial cooking installations in other places can show as good or better records for a nine-year period. But it can not be said of many of them, as is the case with Bailey's cafeteria, that the increase was made against the competition of 1050-BTU natural gas at 26 cents per thousand.

This is a story of load *growth*—growth carefully tended and cultivated by close attention to the customer's problems and by constant readiness with suggestions for their solution. The record appears in the accompanying tabulated data. And here follows the story.

On July 12, 1934, Mr. and Mrs. Bailey opened to the public West Virginia's largest and most modern cafeteria. At that time the cafeteria consisted of one large dining room with a seating capacity of 210. An additional dining room with a seating capacity of 84 was added in 1937 to serve the increasing number of customers better.

For the first year and a half of operation the average daily number of persons served was 900 to 1,200. Today the daily average is from 1,800 to 2,200. The year 1944 should total approximately 600,000 meals—with only 300 operating days, due to being closed Sundays and for a vacation period.

The original installation of commercial electric cooking equipment, shown in Table I for the year 1934, is still in operation and in very good condition, thanks to good inspection and repair service.

After about three years, decision was made to modernize the large cafeteria counter, and engineers of Albert Pick Company were called in to design it. The original counter was of the old-style steam table construction, using water pan and open gas burners for heat. The new counter was constructed of stainless steel throughout, and electrically heated with thermostatically controlled hot pans. The entire counter, including salad, hot food, dessert and pastry sections, was adequately illuminated with concealed lumiline units. The Dole solid refrigerated plate with which the salad counter was equipped eliminated the use of crushed ice. During its six years of operation very little repair service has been required for this counter unit.

Table I. Chronological Record of Equipment Installations

Equipment	Connected load	Installed
1 2-bucket egg boiler	1 kw	1934
1 4-drawer roll warmer	1 kw	1934
2 4-slice bread toasters	4.9 kw	1934
1 2-section waffle baker	1.32kw	1934
2 vertical broilers	12 kw	1936
12 hot pans in new service counter	7 kw	1937
6 single-unit coffee servers	3.9 kw	1937
2 2.6-kw fry kettles*	5.2 kw	1937
1 7-kw fry kettle	7 kw	1940
1 3-unit coffee urn	4 kw	1941
1 2-deck oven	9.2 kw	1943
1 7-kw fry kettle	7 kw	1944
Total connected load	58.32kw	

* These fry kettles are not included in the total of connected load. When the first 7-kw kettle was installed in 1940, they were removed, reconditioned and sold and are now in daily operation in another restaurant.

*Food Service Engineer.

In 1936 two electric broilers were installed for broiled steak and chop production for dinner-time sales. To improve floor service to customers six electric coffee servers were installed at various locations in the dining room in 1937.

As business continued to grow and peak loads began to increase on the gas ranges, two counter-type automatic electric fry kettles were installed in the kitchen. This equipment greatly relieved gas range cooking tops for other production and immediately showed tremendous savings in cooking fats and improvement in fried foods.

These kettles operated at peak production until June, 1940, when one 7-kw. fry kettle with floor stand was installed. The smaller kettles were completely overhauled and placed in first-class condition and immediately resold to other food service operators. They are still in use today.

Table II. Billing Record of 9½ Years

Year	Kw-hr.	Cost	Average per Kw-hr.
1934 (6 Mos.)	24,398	$743.59	3.06¢
1935	69,135	1,955.92	2.83¢
1936	93,100	2,339.59	2.52¢
1937	101,289	2,492.06	2.47¢
1938	128,336	2,947.44	2.3¢
1939	140,980	3,207.41	2.29¢
1940	139,972	3,017.00	2.15¢
1941	162,328	3,170.18	1.95¢
1942	173,506	3,360.67	1.93¢
1943*	150,179	3,044.73	2.03¢
Totals	1,183,223	$26,278.59	2.3 ¢

* Fewer operating days during year 1943 because of closing for two weeks vacation and on Sundays.

The original coffee service was replaced in 1936 with gas urns. In 1941, a new style unit was installed, consisting of a self-contained battery of two 6-gallon coffee urns and one 12-gallon water urn. These are electrically heated with immersion units with manual 3-heat switch control. This battery has proved very satisfactory, with no service required in the past three years.

From the beginning Mr. and Mrs. Bailey have always done their own baking. Their original pastry shop was equipped with two 4-deck gas heated uninsulated ovens. These produced all baked products except hard rolls, which were purchased from a local baker. As steam is required for hard roll production, these gas ovens could not be so equipped.

In October, 1943, the condition of these ovens, after some nine years of hard use, made replacement necessary. Naturally, the decision was for new electric ovens, and in November, 1943, installation was made in the pastry shop of a 2-deck oven. This unit consists of one 125-lb. capacity roast section, and one 20-loaf bake section. A larger unit could not be installed because of inadequacy of the service entrance.

The future was considered in making selection of the roast and bake oven combination as the intention is completely to remodel the main kitchen and electrify it throughout after the war. The roast oven section can then be relocated in the main kitchen and two more like sections added to it. The same will be true in the pastry shop, with two more decks added to the present bake oven section.

Effect of Rationing

Since March, 1943, with the rationing of foods—especially meats—it became necessary to resort more to fish, poultry and other items, among them old-fashioned fried mush. The original four gas range sections are still operating at peak production, and to add other items meant greater use of other methods of cooking—such as deep fat frying.

The original 25-lb. capacity fry kettle continued to operate at peak capacity and the load on it could not be increased. In October, 1943, application to W.P.B. was filed for an additional 7-kw. fry kettle, based on the heavy increase in use of meat substitutes. On January 18, 1944, this additional kettle was placed in operation and immediately proved its value.

When the new building in which this cafeteria is located was constructed in 1934 no one evidently ever considered complete electric cooking —thinking that 26 cents, 1,050-B.t.u. natural gas would always be cheaper than electricity for restaurant operators. Accordingly, only 100-amp., 3-wire, 115/230 volt lighting service facilities were installed, and only 200-amp., 230 volt, 3-phase power service facilities. Included in the power requirements are 25 hp. of air conditioning load and approximately 10 hp. of miscellaneous power load, such as refrigerators, dish washers, grinders, slicers, and other labor-saving motor-driven kitchen equipment.

While a sufficient margin of safety exists for additional lighting load, the possibilities for this are very remote unless the cafeteria is enlarged again. The last fry kettle installation brings the load to the maximum capacity of power facilities and not another kilowatt can be added.

If and when complete electrification of this cafeteria is carried out, we will recommend not less than 600-amp., 230-volt, 3-phase main power facilities, which should be adequate for years to come to take care of the present potential cooking load of 125 kw.

Table III. Averages of Billing Data

	1942	1943*
Kw.-hr. per month...	14,459	12,515
Monthly bill.....	$280.50	$253.72
Revenue per kw.-hr...	$0.0193	$0.0203
Kw. demand (actual)	58.5	47.1
Power factor.....	0.923	0.912

* Reductions from 1942 caused by closing for 2-weeks vacation and on Sundays.

Now just what does this load mean to us and to the customer?

Value of Load

During the first eighteen months of operation (1934-1935) the average of kilowatt-hours used per month was 5,200, the average bill $149.98, and the average cost per kilowatt-hour $0.0279. This was on a 50-kw. minimum contract tariff, no power factor credits included. Total electric service cost is approximately 1.5 percent of total gross sales of this customer.

Naturally, these figures have changed materially, to the mutual benefit of the customer and also ourselves in the past nine years, as shown in Table II of averages for 1942 and 1943.

The year 1943 shows some changes which are due to rearrangement of methods of operation. Due to labor shortage, the practice of closing two weeks for employees' vacations, and also closing Sundays was put into effect during the year. The vacation period was for two weeks in July. Sunday closing was started in September—all this accounts for 32 less days of operation in 1943. Incidentally, Sunday was the biggest day for sales.

Future new load here should include water heating, ice plant, laundry, quick freeze units, larger refrigeration, water well, and approximately 125 kw. of commercial electric cooking equipment. If second floor dining rooms are added, approximately 15 kw. of lighting load will be required.

Editorials

S. B. WILLIAMS, *Editor*

Amendments to Federal Power Act

STATES' RIGHTS is still a popular subject. Sponsored by members of both parties in the House and in the Senate, the bill to amend the Federal Power Act so as to prevent encroachment of the Federal Power Commission on state jurisdiction brings to a head the sore that has been festering between state and federal government regulation for a long time.

Congress was of the opinion that it had well defined jurisdiction in the original act, but the Supreme Court in the Jersey Central case was of a different opinion. It was this decision that caused the National Association of Railroad and Utilities Commissioners to seek relief by way of limiting legislation.

Opponents of the amendments point out that they open the gates to certain possible abuses. It would be well for all concerned for these possibilities to be before the Congress while it is considering the amendments so that the final draft may be unequivocal.

To charge that these amendments spring from utility opposition to FPC original cost policy is a red herring that will fool no one. This whole jurisdictional battle has been waged by the states. The utilities naturally are interested but, as we have said before, they have had no part in it.

The Federal Power Commission has stated in the past that it has not desired to invade state jurisdictions and engage in intra-state regulation. If this be so and there has been but an honest difference of interpretation of the law, one would expect the Commission to welcome any clarifying amendments.

If the Commission has gotten itself in Dutch with state commissioners it has only itself to blame. Regulation, like everything else, is not a law unto itself. It has a public relations problem, also. The Commission has not been inclined to work out with those affected a mutual understanding and agreement before attempting to put new policies into effect. The Commission might remember that willing compliance is after all the test of the best regulation.

Men Who Make Good in the Services

AMONG THOSE RECEIVING twenty-year pins at a recent employee-award dinner of a large New York department store was a man who had started as a boy in the stockroom. There he stayed until the war came and he was drafted.

Being home on furlough, he was invited to attend the annual dinner to receive the recognition to which his years of employment entitled him. But the man who got the twenty-year pin was not the fellow who left the stock room. He was a captain of the United States Army. He received more than the pin; he was promised a position on the executive staff when he was discharged from the Army.

This was a nice gesture, but the problem in the utility industry is different, principally because there are so many employees who have won high ranks in the services and who are handling jobs much bigger than those they left. Certainly there will be a place for them when they come back, but what place?

These men have been accustomed to handling men, making decisions, administering large projects. They have found themselves in war. A great many may try to stay in service because they don't want to come back to the jobs they left. These men, however, are above the average and there ought to be places for them where they can use the hidden talents that the war has brought out. Let's spot these places now.

Record Attendance at Meetings

NEVER BEFORE have national and regional meetings been so well attended. Everywhere we go, and our staff attends most of the meetings in the electrical industry, record attendances are reported.

At one time people went to conventions, in part at least, for pleasure. It can't be that now, for the formal entertainment of a pre-war convention no longer exists. Moreover, people who travel today have to put up with so many inconveniences in the way of transportation and hotel accommodations that they can hardly be accused of going to meetings now for fun. There must be something most compelling in these meetings to cause so many people to accept today's discomforts. What is it?

As we look over the programs we find little resemblance to pre-war topics. Then speakers told of the progressive things they were doing and what results they were getting. Committees brought out promotional programs and showed how the members of the industry could tie in. They were programs of an industry that was free to build, and to sell. War has changed that condition.

No, the thing that brings people together today is not the normal problems of operation, but the possibility that

they will get some inspiration or guidance to help them plan for the period after the war. People aren't going to meetings today because they have something to tell, something to give, but because they want help.

This need puts a greater responsibility upon associations and program committees. But it puts a still greater responsibility upon the membership to make known their wants. Much of the work of every association is voluntary, which today means greater personal sacrifices than ever before. If the associations are to be of maximum benefit today, these committees must have the maximum of assistance from the people in the industry.

Payments in Lieu of Taxes by Federal Projects

GRADUALLY the unsoundness, as well as the unfairness, of removing government-owned power property from the tax rolls is making an impression in Congress. Only last week the Senate Appropriations Committee criticized the Reclamation Bureau for not setting up electric rates that included collection of money for payments in lieu of taxes.

Some time our legislators will go all the way and look upon taxes or equivalents collected from government projects as assessments not against the government but against the users of the property. When taxes are levied on a private utility it is recognized that, except for unusual war taxes, the taxes are against the users of the service. Why should users of electricity generated in government plants be given special privileges?

This matter has been fought by the public power advocates because taxes or payments in lieu thereof would wipe out much if not all of their competitive rate advantage. The Senate Appropriations Committee now believes this to be an unfair advantage in the distribution of power in a competitive market. The effect, however, we might point out, goes well beyond the competitive market and makes trouble in other areas.

When the result of such tax discrimination is to encourage the purchase of tax-paying private property by some local government and thereby still further reduce national government tax collections the unsoundness of the concept becomes more apparent. In addition, there is a discrimination in favor of consumers of the purchased property, who can then apply against local costs money that formerly went to the national treasury.

The Senate committee suggests legislation requiring federal projects to collect sums in lieu of taxes. How far is the committee willing to go? Does it suggest merely an equivalent for that taken off the tax rolls or an amount equivalent to that paid by private utilities? The former is apt to be but a token payment. The latter is the only way in which discrimination between people can be prevented and incentives to the removal of property from the federal tax rolls be minimized.

Engineering Modesty Not Always a Virtue

RARELY IS THERE an engineer who does not like approbation and applause when he achieves something really new in the art. But just as rare is the engineer who courts the limelight. He is proverbially modest and waits to be coaxed, but maybe he does his company as much harm as he does his own cause when he is too reticent. A utility, for instance, can hardly win too much credit for the good it does to the community served and much of that good hinges on technical achievements.

Technical improvements in electrical systems and service are not, however, conceived and made for the sake of providing material for a favorable publicity program. They have been prompted by managements eager to have electricity fulfill its destiny of being the most versatile way of applying energy for the benefit of mankind in particular areas. That the transformations of those areas have been little less than miraculous, is quickly seized upon by public power advocates, but relatively little has been written to portray the successive steps by which electric power under private auspices has balanced the economy and enhanced the wealth of the territories served. In neither case, however, could these attainments have been achieved without the help of the engineer's incessant anticipation and solution of problems.

Why are not all these technical accomplishments publicized and interpreted, as they take place, in terms of human welfare and comfort? Why let artificial restraints throttle and choke the telling? At a particular moment there is perhaps little incentive to encourage the engineer to recite his new contributions. But for many a company has already come a day when more frankness, more public approach—call it propaganda at the risk of being misunderstood—could have paved an acceptance that would have averted political assault. Is there not, for example, a utility company here and there that missed the credit for pioneering one or more of the following: hydrogen cooling, distance relays, oilless breakers, counterpoises, bushing potential devices? Each seems at first difficult to translate into language the public can grasp but the public-relations fellows know how to do it, if only they are helped to learn about them.

Productive industry, and particularly the electrical manufacturers, have done a most creditable job in translating into popular language the technical contributions made by their engineers and scientists. Many of these things originate with utility engineers. They are equally capable of simple interpretation.

There are companies right now which could start building a favorable public by speaking out about their technical achievements. There are engineers, too, who could start the ball rolling by telling their public relations associates about the very things they have been doing. While they are holding back their employers are paying a hidden penalty for the reluctance.

Washington Comment

By R. N. LARKIN, Washington Correspondent

Congress Gets Amendments to Federal Power Act

THE LONG AWAITED proposals for amendment of the Federal Power Act have finally been laid before Congress with bi-partisan sponsorship. Since they stand to affect such a large part of the nation's electric power industry, they merit as close scrutiny as is possible before becoming law.

Identical bills, prepared by the National Association of Railroad and Utilities Commissioners, which is engaged in a "states rights" dispute with the Federal Power Commission, have been introduced by Senators Brooks and Johnson, Illinois Republican and Colorado Democrat respectively, and by Representatives Boren and Brown, Oklahoma Democrat and Ohio Republican respectively. They amend Section 201 of the act so as:

Essence of Changes

To redefine a "public utility" as any person who sells energy in interstate commerce at wholesale or who so transmits energy for compensation.

To define emergency service as temporary service during a period of emergency.

To define "slop over" as energy which passes between systems as a result of a sudden demand which momentarily unbalances such systems.

To provide that energy shall not be considered to have been sold at wholesale nor to have been transmitted for compensation when it passes between systems in pursuance of a contract for emergency service, or of a contract which provides that net energy balances shall be paid for on the basis of production or purchase cost, or when it passes between systems because of "slop over."

Depending on whose tale is being told at the moment, these amendments are described as an attempt to eliminate a dual jurisdiction which has proved detrimental to the rights of state regulation, or an attempt to scuttle the FPC. But there is agreement on one point at least—that the amendments, if they become law, would junk the Jersey Central Power and Light precedent.

An example of one certain effect of the amendments can be found in the cases of the New Jersey Power and Light and the Metropolitan Edison, each of which serves the other at wholesale under a contract which provides essentially that net energy balances be paid for on a cost basis. Metropolitan serves Easton, Pa. New Jersey Power serves Phillipsburg, N. J. The state line runs down the Delaware River which separates the systems. Under the Jersey Central decision each company is clearly under FPC jurisdiction. Just as clearly, neither would be if the amendments became law.

Opponents Arguments

Opponents of the amendments declare that they open the door to "stateline — transmission — companies," whereby the only companies to remain under FPC jurisdiction would be companies which owned only tiny stretches of line actually crossing state borders. These would connect with generating companies at either end which would be beyond the reach of FPC, possibly situated in states having no regulation of electric utilities.

Another error, say the opponents, lies in the redefinition of the term "public utility." The present definition is based upon ownership and operation of facilities used in interstate commerce. The amendments change this basis to the sale or transmission of energy in interstate commerce for compensation. It is feared that the change would cast considerable doubt on the applicability of numerous court decisions which have tediously been fought out over the last nine years to a point at which everyone knows where he stands under the act.

Finally, opponents of the amendments charge that the "states' rights" angle of the whole move is merely window dressing to conceal the hatred of many private utilities for just one requirement of federal jurisdiction—that which permits FPC to determine original cost of utility properties. This authority, they contend, evokes bitter-end opposition because it requires classification of accounts to a standard posed by FPC rather than to one chosen by the company. It also requires elimination of excesses over what FPC determines to be original cost, and does this in such a way as possibly to reduce a company's rate base and possibly to impair dividend payments and the earned surplus or capital surplus accounts.

Dual Jurisdiction Opposed

Proponents of the amendments say the blanket condemnation accorded them is incorrect in several respects. They say the amendments are designed to eliminate a dual jurisdiction brought about by the Jersey Central Power and Light decision which was regarded by a majority of NARUC members as an invasion of state jurisdiction, even though the New Jersey Commission disagreed. They disclaim any other intention for the amendments, including any attempt to disestablish the Hartford Electric Light Co. precedent, which is also regarded by some as an invasion of state regulatory jurisdiction. They seek a return to the status in which the FPC would fill the hiatus in regulation brought about by the Attleboro case, in which it was held that a state commission could not regulate the wholesale rate of power moved into that state.

A sponsor of the amendments described himself as impressed with the widespread complaint of the state commissions, and suggested that nothing can be harmed by bringing the issue before a Congressional committee where any real fault can be discovered and a satisfactory remedy devised.

NEWS OF THE WEEK

Treasury to Discontinue Energy Tax Exemption

Electricity sales to Government will be subject to 3.33 percent levy after June 1 — Exemption eliminated in revenue bill — Telephone, telegraph, transportation industries exemption continued

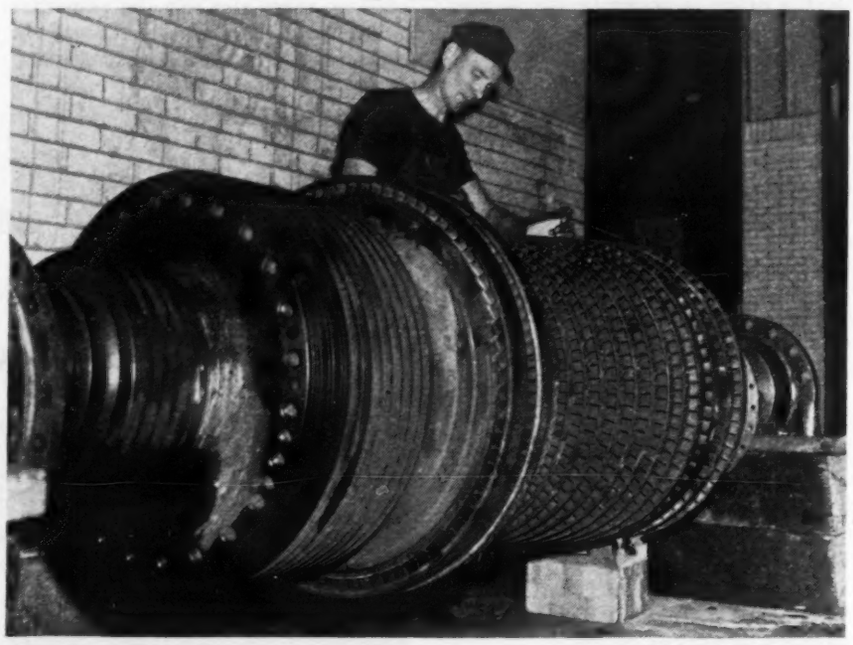
Treasury Secretary Henry Morgenthau does not intend "at this time" to continue the tax exemption on electric energy sold to the federal government for domestic or commercial use, an Internal Revenue Bureau spokesman told ELECTRICAL WORLD "informally" this week. As a result, the 3.33 percent levy on energy sales will affect government purchases of electricity for domestic and commercial use after June 1. The standing exemption was eliminated in the recent revenue bill, but the Treasury was given authority to continue the exemption if it chose to do so.

Before the Treasury Department's chief counsel this week was a recommendation for a determination as to which government uses are classifiable as commercial or domestic and which are industrial. Industrial sales are not taxable.

Last week the Treasury continued for the telephone, telegraph and transportation industries the exemption it plans to refuse the electric industry. These three industries are allowed to add the tax to the bill, so the failure to continue the exemption would result in the government paying itself a tax. Since the electric industry is not allowed to add the tax to the bill but must pay it out of revenue, it will amount to an additional reduction of revenue through taxation.

It was indicated that the recommendation made to the Treasury chief counsel by the Internal Revenue Department as a basis for determination of which government service is commercial or domestic and which is industrial was broadly in favor of the taxable classifications. It was believed, however, that service to a government-owned war plant which is operated by private management, such as the Lake Catherine, Ark., aluminum plant, would be held to be industrial and therefore not taxable.

An Internal Revenue spokesman pointed out that domestic or commercial electric service to the government, extending beyond the June 1 deadline, which was contracted for before June 1 would be exempt from the tax through the life of the contract. Since most federal contracts expire at the close of the federal fiscal year, June 30, it was not believed that this contingency would afford electric companies any vast relief. Presumably, however, contracts for the fiscal year ending June 30, 1945, which are specifically renewed



OVERHAULING JOB—Following its good performance of being on the line for 49 months since its previous inspection, No. 5 turbo-generator at the West End power station of the Cincinnati Gas & Electric Co., has just been overhauled. The tuning-up job began Feb. 11 and the unit went back into service on April 10. In the accompanying illustration of the main steam turbine rotor a repairman helper is cleaning deposits from the blading. The turbine rotor had passed over 22 billion pounds of steam but was remarkably clean. Except for straightening slightly bent impulse blades the work done to the machine was almost entirely routine

before June 1 would be exempt from the tax.

Although a spokesman for the Potomac Electric Power Co., serving the seat of government in the District of Columbia, declined to comment, it was apparent that Pepco would be vitally affected by the decision not to continue the exemption, since 50 percent of its 1943 gross business of more than $22,000,000 was federal government load. Pepco serves not only government offices but such loads as the Washington Navy Yard and certain others which are normally classed as industrial loads. In advance of Treasury chief counsel's ruling, it was not immediately known what distinction would be made with regard to federal activities in the district.

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WPB Plan Provides for 2,000,000 Irons

WPB reiterated its intention to manufacture 2,000,000 electric irons in 1944 this week with the statement that it anticipates that all of them can be produced without interference with the military production program.

In making this announcement, WPB issued quotas totaling 193,625 additional irons to three manufacturers, raising the total specifically assigned for manufacture to approximately 395,000. Quotas issued some weeks ago to nine manufacturers (ELECTRICAL WORLD, April 22, 1944, page 8) still are valid, WPB announced.

New quotas are as follows:

Westinghouse Electric & Manufacturing Co., Mansfield, O., 157,000; Dominion Electrical Manufacturing Co., Mansfield, O., 35,000; and New York Pressing Machine Co., New York City, 1,625.

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Start Work on Installing Three Transformers

Reflecting additions to war plants in the Vernon, Calif., industrial area, work is now in progress to increase the capacity of the Southern California Edison Co.'s Vernon City substation to 90,000 kva. Three new 10,000-kva. transformers are being installed to form a 30,000-kva. bank to augment two existing 30,000-kva. banks.

A four feeder position outdoor rack structure is being constructed to provide increased feeder capacity into the area at 7.2 kv. The underground duct system from the plant to Santa Fe Ave. is being extended to accommodate eight underground feeders, one of which is being installed at this time.

Promote System Evolution; Standards Discussed

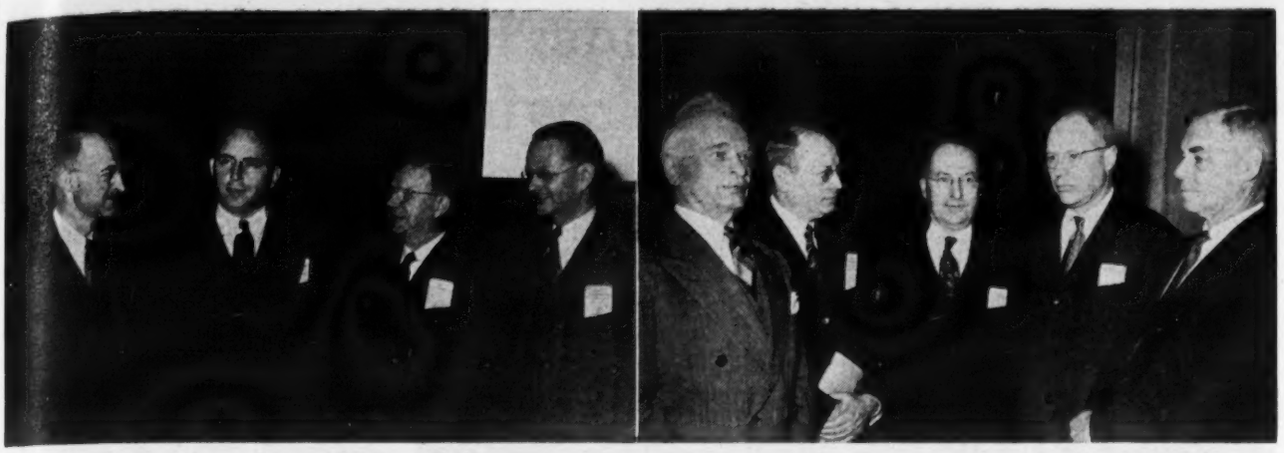
Edison Electric Institute committee meetings resume engineering analysis of past practices and projection of new ones to lay foundation for future load-carrying ability

Evidence that electric utilities have practically completed the necessary expedients and improvisation successfully to meet the war emergency was found in the sessions of the transmission and distribution and electrical equipment committees of Edison Electric Institute in Chicago May 1 to 3. Programs dealt largely with the major problem of providing future distribution at least cost compatible with the desirable levels of reliability and quality. The 13-kv. distribution of Dallas (ELECTRICAL WORLD, April 1 and 15, 1944), the matter of system relaying, generator standardization, banking and the seat of the major investment items in distribution were major topics in the two committees.

Much interest was manifested in Rochester data presented by George H. Fiedler which showed that, for a theoretical but typical square mile, a radial system to serve a 2,000-va. customer would cost 35% as much per va. as for a 500-va. user; also that the respective percentages of cost allocated beyond the transformer secondary terminals (secondary, service, meter) are 54 and 74. His conclusion was the greatest distribution savings must be made on the customer's side of the transformer; nor did he foresee any radical changes in distribution patterns. Also doubling of demand could be met by a 32 percent increase in outlay. J. S. Maloy (West Penn) asserted that present layouts are generally inadequate for the prospective fluctuating air conditioning load. George VanAntwerp (Philadelphia) rated the deep-freeze unit a worse problem. A doubling of rural load a year after the war was foreseen by C. W. Minard (Omaha); further, that the 10, 20, 30 percent stages of system load increase would overload the regulators 15, 28 and 48%, the cables 6, 16 and 21 percent and the overhead lines 30, 32, 35 percent.

Modified radial can at times outdo the network, said F. W. Nimmer (Akron), who asserted that he would welcome a self-regulating transformer and appliances with more voltage latitude. R. O. Sutherland (Davenport) went a step further in visualizing an

AT EEI TECHNICAL SESSIONS—Three-phase transformer standards were discussed at an informal evening session held during the EEI engineering conferences in Chicago, last week. Sponsoring the discussions were members of the joint NEMA-EEI committee. (L. to r.): A. E. Silver, Ebasco Services; H. A. Enos, American Gas & Electric; W. A. Sumner, Westinghouse; F. E. Sanford, Cincinnati Gas & Electric; E. V. Sayles, Consumers Power; H. M. Jalonack, G.E.; and J. B. Hodtum, Allis-Chalmers



EXAMINE SYSTEM RELAYING AND EQUIPMENT DESIGN—Basic principles of system relaying were examined at the Tuesday symposium on relaying of the electrical equipment group. Discussion leaders were (L. to r.): G. B. Dodds, Duquesne Light; H. R. Paxson, and H. A. Dryar, Philadelphia Electric, and T. R. Halman, Detroit Edison. Advances in electrical equipment design were presented by manufacturers at the Tuesday afternoon electrical equipment committee meeting (L. to r.): S. H. Mortensen, Allis-Chalmers; C. F. Wagner, Westinghouse; R. T. Henry, Buffalo, Niagara & Eastern; B. Van Ness, Consolidated Gas Electric Light & Power Co. of Baltimore; and D. M. Jones, General Electric

electronic converter which would tap each customer individually off the line (without a conventional transformer); he also suggested that buried cable and a 250-volt system are desirable for active consideration.

Compromised phasing of double circuits was reported by W. H. Knutz (No. Ind. Pub. Ser.) as a way of reducing the vector resultant of leakage currents and checking the frequent burning of pole tops and arms. He also described a V-arrangement of self-braced arms which has experienced outages to only 1½ percent the rate incurred with unimproved design. On the pole burning, VanAntwerp said that the heating concentrates far enough in, along the through-bolt, to escape the quenching by rain and the rapid heat loss at the surface. Semi-conducting paints were suggested as worth trying, to dissipate the leakage currents.

Kva. dropped by blown fuses on the Cincinnati system were reported by V. G. Rettig to have been halved by a progressive adoption of 85N branch line fuses where maximum short circuit current is greater than 650 amp. (unless they will not coordinate with feeder relays) and 45N for 650 amp. or less; average time to replace a fuse is 50 minutes. Fusing of secondaries in banking arrangements was the subject of an 11-company roundup by W. R. Bullard (Ebasco Services). Mostly the practice is to bank only 2-4 transformers but one company averages 95 and, over 20 years, as many as 150 in a single bank. Cascading of primary fuses seems not to concern the advocates.

Acceptable counterparts for natural rubber compounds are possible, said E. W. Davis (Simplex), in reporting the status of Buna S (GR-S) insulation. The data showed comfortable correlation for most indexes but much, he said, depends on the respective compoundings.

Sessions of the electrical equipment committee; chairmaned by R. T. Henry, Buffalo, Niagara and Eastern, featured a symposium on basic principles of system relaying. Prepared papers by H. R. Paxson. Philadelphia Electric; G. B. Dodds, Duquesne Light, and T. R. Halman, Detroit Edison, provided a springboard for lively discussion.

In Boston, C. A. Corney reported, his company had found it sufficient to protect against single rather than simultaneous system faults in determining relay selectivity requirements.

Relay Requirements

C. L. Headley of Baltimore expressed conviction that the relay system should cover as many abnormal conditions as possible. Protection against simultaneous faults where two feeders are on the same poles is desirable, he said, but this construction should be avoided. Justification for the second automatic reclosure of breakers was questioned by Headley, who pointed out that reclosures coming more than 15 seconds after initial operation present a public hazard where wires are down. On the Baltimore 4 kv. system 73 percent of all faults are cleared by the first reclosure, he said. In the light of this the gain from a second reclosure was doubtful, he felt, in view of shocks imposed on the system.

H. P. St. Clair, American Gas and Electric, favored a second reclosure. It is often a "life saver" if the breaker fails to latch. Also a second fault within three minutes of the first would lock out a single reclosure breaker. In such cases a second reclosure is handy.

H. P. Sleeper, Public Service of New Jersey, laid down three specifications for the "ideal" relay system: (1) It should impose no limitations on system design; (2) It should operate as independent units of the system and (3) be fast enough to permit faulted equipment to be restored to operation as soon as the fault is removed. Maximum time to clear should not exceed ½ second, he asserted. No present ground fault relay scheme fits these specifications today, Sleeper stated. High voltage transmission relay schemes of the present approach these requirements, but more attention is needed to reduce contact maintenance. On medium voltage transmission; distance, phase and ground relaying comes the closest to the specifications, but it does not yet fit the half second clearing time requirement. Protection of distribution systems is not satisfactory; ground relaying is inadequate, Sleeper asserted.

Discussion of turbo-generator standardization, presented at the Tuesday afternoon session by M. S. Oldacre, chairman of the AIEE group, centered around the recommendations for generators to correspond with standard turbines recommended by the ASME group. The AIEE group proposed that more reactive capacity be provided in future generators in proportion to the turbine guaranteed capability and that some of the other generator characteristics be altered to obtain the same pull-out torque without increasing the size of the generator. These proposals for the generator fit in with the recommendations of the ASME group for turbines that the maximum overload capacity be in general less than present practice.

H. W. Eales, Public Utility Engineering and Service, said that while this standardization work held promise of

price reduction, he felt that the industry was entitled to know what it is gaining in money by the reduction in overload capacity, short-circuit ratio and increase in power factor of the proposed standard machines.

Several discussers expressed conviction that turbine generators should be rated in accordance with the guaranteed maximum capability rather than have an overload capacity. Some reluctance was also expressed at the ASME proposal to drop the 50,000 kw. machine size.

An informal evening discussion of the three-phase pole-type transformer was conducted by the joint NEMA-EEI committee to elicit the interest in the polyphase design and, particularly, any preference for the vertical or horizontal configuration. The show of hands was inconclusive.

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Chromium, Nickel Curb Lifted by WPB

WPB has revoked its order L-134 restricting the use of chromium, nickel or any alloy of either in the manufacture of industrial instruments, control valves and regulators.

Manufacturers may fill orders for these items which were placed before May 3 with products conforming to the restrictions or not conforming thereto, at their own option. For scheduling purposes, WPB has ruled that orders placed before May 3 which are canceled and replaced are new orders and that customers who, on or after May 3, change previously placed orders to enable them to be filled with unrestricted instruments must consider them as new orders, with original order canceled. Likewise, any change in a purchase order placed before May 3 which would interrupt or disrupt production schedules must be considered a cancelation of the original order and the issuance of new replacing order.

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Drop Retroactive Ruling on Inventory Limits

Because of complaints from WPB's Compliance Division, the Office of War Utilities has been forced to discontinue the practice of granting retroactive authorization to exceed the inventory limits established by order U-1.

As a result, utilities will have to keep their inventory and stock delivery records sufficiently current to enable them to apply for authorization to exceed the limits, if necessary, before their inventory actually passes the prescribed figures.

Loadings, Resumption, Fuse-blowings Canvassed

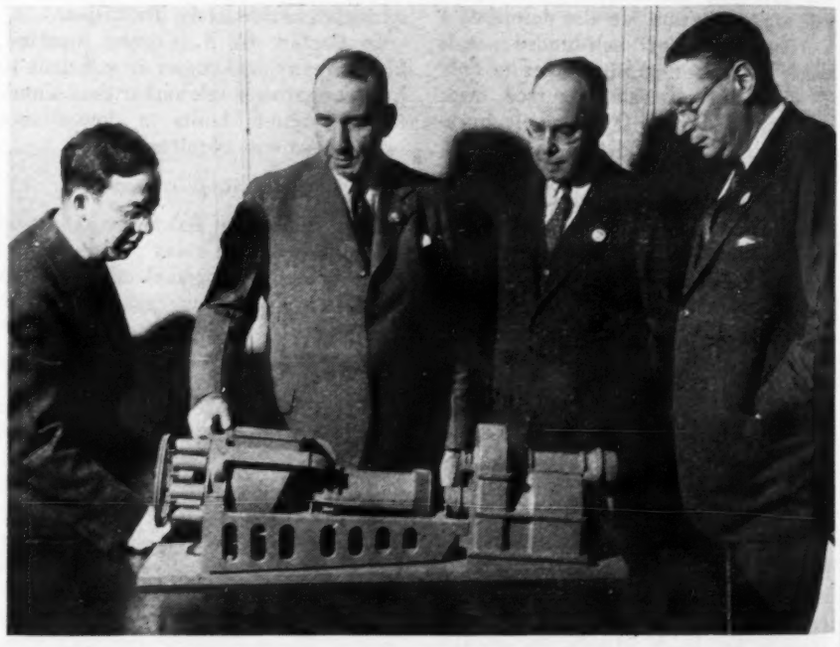
Committee of Pennsylvania Electric Association discusses resumption after outage, relation of burnouts to fuse blowings, glaze, sectionalization and lightning-proofing

Resumption of load after outage, sectionalizing devices, efficacy of transmission line lightning protection, fuse blowing versus transformer burnouts and the responsibility of the load-curve-conscious distribution engineer were prominent matters of discussion at a meeting of the transmission and distribution committee of the P.E.A. in Harrisburg May 5 and 6.

Distribution engineers will do well to be more load-curve conscious if they are to keep commercial departments from promoting water heater and other loads beyond the capacity of distribution to carry the resultant peaks, said D. K. Blake (General Electric). He emphasized other possible critical conditions which may attend revival and expansion of domestic loading and urged a familiarity with the characteristics of the circuits and the various devices which can tax their capacity to handle either steady or flicker-causing dips. Faith was expressed by him in the shorting contactor like Detroit is testing out.

Resumption of load after 30-minute interruption on a 2.3-kv. feeder serving 2,388 customers (1,744 refrigerators, 295 water pumps) showed pick-up current 4.22 times the peak value. E. O. Painter, who presented these Pittsburgh data, suggested voltage-actuated sectionalizers with graduated time-delay as a remedy which could also function as normal automatic fault sectionalizing devices.

Continuing analysis by T. S. Hawley of the performance of automatic-reclosing line-sectionalizing devices covered eight companies with 71 of the oil-filled



DISCUSS GAS TURBINE—Examining model of 3,000 hp. gas turbine for ship propulsion are: (L. to r.): J. Kenneth Salisbury, turbine engineering division, General Electric Co.; A. R. Smith, manager of the company's turbine engineering division; C. S. Coggeshall, manager turbine division and H. V. Erben, manager central station divisions, who was just elected a vice-president of the company. In a paper presented this week at the national meeting of the A.S.M.E. oil and gas power division in Tulsa, Mr. Salisbury indicated that the gas turbine offered attractive possibilities for certain applications on land, sea and in the air, but that it should not be regarded as a prime mover that will completely replace existing types. He cited the improbability of the gas turbine replacing large steam turbines in central stations as a case in point

type and no faulty operations. There were only eight faulty operations of 347 of the non-oil type and two or more of these instances might not be chargeable to defects in the equipment. Further studies will be aimed at eliciting the economic merits.

Preliminary annual data collected by W. H. Jones from 17 companies having over 200,000 single-phase transformers showed average lightning failure rate of 0.57 per 100 for all types of protection; interconnected, 0.49; non-interconnected, 0.86; without protection, 0.92; self-protected, 0.38; complete internal protection, 0.40. The corresponding fuse-blowings of 97,000 transformers were 6.98, 3.31, 2.72, 13.18, 21.37, 0.57.

In another study on 85,000 2.4-kv. distribution transformers among seven companies, the failures due to overloads and secondary faults were reported by J. G. Charest to be 0.35 per 100, the 1½-kva. rating showing the highest (0.68) index; no clear correlation was indicated for failures and fuse sizes. Data on 37,731 transformers showed a fuse-blowing rate (2.2 per 100) about six times the failure rate and there was evidence, inconclusive however, that the smallest fuses give the highest rates.

The 66-kv. tower lines of Duquesne Light with double wood arms and above-and-below shield wires (ELECTRICAL WORLD, May 17, 1941, pages 50–53) have in the three ensuing years, according to W. R. Metzger, shown 0.67 faults per year against the predicted 0.71 and a prior value of 6.6.

Glaze data (1927-1942) from Pennsylvania Water & Power showed only once in 16 years a case of ½-in. or more ice with a wind velocity as high as 20 mph. All other 46 reports showed less than 20 mph.

Conducting paint was said by C. C. Moler to be considered beneficial in reducing pin burning by insulator leakage current.

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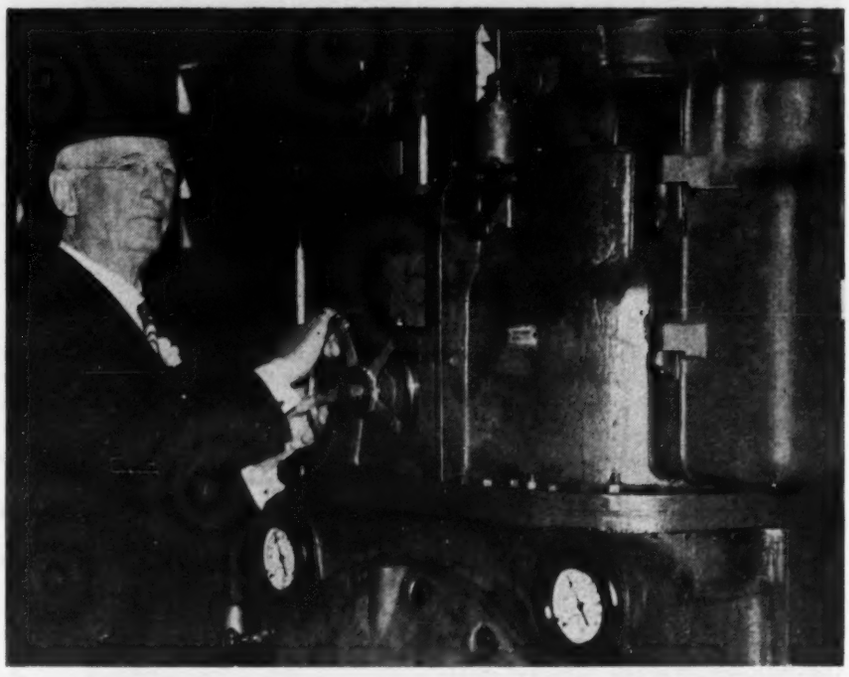
Energy Output Increases

Production of electric energy for public use during the month of March, 1944, totaled 19,468,001,000 kw.-hr., according to reports filed with the Federal Power Commission. This is an increase of 11.0 percent when compared with March, 1943.

The average daily production of electric energy for public use for March, 1944, was 669,003,000 kw.-hr., a decrease of 2.1 percent when compared with the average daily production during February.

Production by water power in March amounted to 6.989,323,000 kw.-hr., or 35.9 percent of the total output.



TURNS THE STARTING WHEEL—In the presence of a group of the utility's officials and engineers, Charles M. Cohn, president of the Consolidated Gas, Electric Light & Power Co. of Baltimore, turned the starting wheel last week to bring up to speed the new 50,000-kw. steam turbine-generator in the new Riverside Plant at Dundalk

New 50,000 kw. Unit Put in Operation

On May 1 Charles M. Cohn, president of the Consolidated Gas Electric Light & Power Co. of Baltimore, turned the starting wheel to bring up to speed the new 50,000-kw. steam turbine-generator in the company's new Riverside Plant at Dundalk. This placed in operation the company's third powerful electric generating unit of this latest type.

The new generator has a rating of 50,000 kw., three-phase, 60-cycles, 3,600 rpm., steam pressure 85 psi., steam temperature 900 deg. F.

"Completion of this unit is the culmination of a program inaugurated before Pearl Harbor," Mr. Cohn said. Foreseeing the need of greatly increased power requirements, the Consolidated's management developed a program for an expansion of 175,000 kw.—approximately 235,000 hp.—in its electric generating facilities. This program, which brought about an increase of 70 percent in generating capacity, has insured an adequate supply of electricity for war industries, war workers, and regular customers within the 2,269 square mile area served by the company.

"The company takes pride in the fact," Mr. Cohn said, "that no war production in the Baltimore Area has been delayed by lack of adequate power supply, notwithstanding shortage of manpower, difficulties in securing necessary equipment and materials, and the greatly increased cost of carrying on the company's operations. Preparedness has been our guiding policy."

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Maryland Utilities Group Elects New Officers

At the annual meeting of the Maryland Utilities Association held recently in Baltimore, the following officers were elected: President, William B. Bennett, Capital Transit Co., Washington, D. C.; vice-president, Henry S. Davis, Conowingo Power Co., Elkton, Md.; treasurer, J. Carl Fisher, Consolidated Gas, Electric Light & Power Co., Baltimore, Md., and secretary, Raymond C. Brehaut, Washington Gas Light Co., Washington, D. C.

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Energy Requirements

Electric energy requirements in March amounted to 19,341,681,000 kw.-hr., the Federal Power Commission has announced, a gain of 11.0 percent over the corresponding month the previous year. Comparable percentage increase reported for the preceding month was 16.2 in comparison with February, 1943. The commission stated that estimates of December 1944 peak demands made by the Class I electric utility systems in their March reports amounted to 38,719,083 kw.

Opposes OPA Pressure on Regulatory Boards

Right of agency to force commissions to accept its opinion on inflationary aspect of utility rate increases argued before high court in Hudson-Manhattan Railroad case

The right of the Office of Price Administration to force regulatory commissions to act upon its contentions as to the inflationary aspect of utility rate increases was argued before the Supreme Court last week as the Interstate Commerce Commission and the Hudson-Manhattan Railroad Co. appealed from a decision by a special U. S. District Court in New Jersey enjoining a 1.1 cent rate boost approved by ICC.

Counsel John Finerty, representing the railroad, charged that the lower court had invaded the jurisdiction of the ICC when it threw out the approved rate boost after ICC had limited a reopening of the case to one issue—that of how to correct an impossible situation which arose out of the rate increase order—and also when it rejected the ICC order on the basis of having "prejudged" OPA evidence.

The case arose out of a plea by the company to ICC for a boost from eight to ten cents of the fare on its subway line from Jersey City to New York. ICC last June granted a one-cent increase, but reopened the case in July when the company protested that its coin boxes could not handle any combination of coins making up nine cents. ICC limited the reopened case to the problem of what to do about this mechanical difficulty.

Orders Token Plan

In August, it ordered a new token arrangement which raised the rate to 9.1 cents. Thereupon, the city of Jersey City filed a complaint with the U. S. District Court of New Jersey enjoining the amended ICC order, after which ICC reopened the case a second time to consider only the propriety of its substitution of the token arrangement for the flat nine-cent fare. Jersey City and OPA objected to this limitation, and sought to introduce cost and income statements to show the nine-cent fare excessive in view of passenger increases, but were denied this privilege. In November, the ICC made final its order incorporating the token arrangement setting fares at 9.1 cents, stating that it had reviewed the evidence which OPA had unsuccessfully tried to introduce and that it would not have changed its decision. Thereafter, the District Court enjoined the ICC orders insofar as they permitted any rate over eight cents, saying in part:

"It does seem from these (executive orders on stabilization) that the commission here is under a distinct duty in this particular case to give full effect to wartime conditions and the stabilization legislation."

Finerty argued that OPA had admitted that the H-M rate increase alone would not be inflationary, and insisted for his part that it would be deflationary. He said OPA had merely entered appearances in the case from its inception and made no attempt to put in evidence until the second time the case was reopened. At no time, he said, did OPA put in evidence as to inflationary aspects of the increase but only attempted at long last to put in evidence on the reasonableness of the rates, which he insisted was not under OPA's jurisdiction. He argued that since the matter affected only two of all the company's rates and reduced one of these, it could not be called a general rate increase, to which OPA's jurisdiction is confined. He denied that the case was decided in 1943 on 1942 figures which the Office of Price Administration said were "stale."

OPA Attorney David F. Cavers, assistant general counsel, said its allegation that it failed to get a full and fair hearing by ICC arose from its belief that when the ICC first reopened the case in July, 1943, on demonstration of the impracticability of the flat nine cent fare, the entire case was reopened and evidence should be submitted to determine whether the fare should be remand to eight cents, at which level it has stayed throughout because of the company's inability to collect the nine cent fare. He said figures on which the case was decided were all at least 13 months old and that OPA was treated unfairly when it was not allowed to introduced more recent figures in revenues and costs.

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MEETINGS

Previously Listed

Arkansas Utilities Association—Annual convention, Marion Hotel, Little Rock, Ark., May 15-16. R. E. Ritchie, secretary, P.O. Box 551, Little Rock, Ark.

Pacific Coast Electrical Association—Southern section, Ambassador Hotel, Los Angeles, Calif., May 17. Victor W. Hartley, managing director, 601 W. Fifth St., Los Angeles, Calif.

Council of Electric Operating Companies—Contributors' meeting Edgewater Beach Hotel, Chicago, Ill., May 18. T. P. Walker, president, 13th and F Sts., N.W., Washington 5, D. C.

Wisconsin Utilities Association — Conference of all sections, Pfister Hotel, Milwaukee, Wisc., May 19. A. F. Herwig, executive secretary, 135 W. Wells St., Milwaukee, Wisc.

Illuminating Engineering Society — Great Lakes regional meeting, Cincinnati, Ohio, May 20. G. R. Baumgartner, regional vice-president, General Electric Co., Nela Park, Cleveland 12, Ohio.

Edison Electric Institute—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., June 6-7. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

Public Utilities Advertising Association — Annual meeting, Palmer House, Chicago, Ill., June 6-8. Waldo M. Wright, secretary, Amarillo Gas Co., Amarillo, Texas.

National District Heating Association — Annual meeting, William Penn Hotel, Pittsburgh, Pa., June 14-15. John F. Collins, Jr., secretary-treasurer, 827 N. Euclid Ave., Pittsburgh, Pa.

Iowa Utilities Association—Post-war planning conference, Des Moines, Iowa, June 19-20. Wm. R. Blake, secretary-manager, 606 Fleming Bldg., Des Moines, Iowa.

American Society of Agricultural Engineers—Annual meeting, Schroeder Hotel, Milwaukee, Wis., June 19-21. Raymond Olney, secretary, St. Joseph, Mich.

American Society of Mechanical Engineers—Semi-annual meeting, William Penn Hotel, Pittsburgh, Pa., June 19-22. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York 18, N. Y.

Canadian Electrical Association—Annual meeting, Murray Bay, Que., Canada, June 22-23. B. C. Fairchild, managing director, 804 Tramways Bldg., Montreal, Que.

Society for Promotion of Engineering Education—Annual meeting University of Cincinnati, Cincinnati, Ohio, June 25-28. F. L. Bishop, secretary, University of Pittsburgh, Pittsburgh, Pa.

American Society for Testing Materials—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., June 26-30. Robert J. Painter, assistant secretary, 260 S. Broad St., Philadelphia 2, Pa.

American Institute of Electrical Engineers—National technical meeting, Jefferson Hotel, St. Louis, Mo., June 26-30. H. H. Henline, national secretary, 33 W. 39th St., New York 18, N. Y.

Utility Gets Franchise for Portland Line

Public ownership lost to private ownership in a bitter and protracted fight for permission to construct a 115,000-volt transmission line into Portland, Ore., when the city, on April 28, turned down the application of Bonneville Power Administration and granted the franchise to Portland General Electric Co. (ELECTRICAL WORLD, April 2, page 21.)

Awarding of the franchise to P.G.E. lost for Bonneville the right to construct what would have been the first public-owned power line to enter the city of Portland. Cost of the line will be only about $250,000, but the public vs. private ownership fight has loomed large in the Pacific Northwest since the franchise issue arose more than a year ago.

Output Curve Turns Downward

The output curve moved downward during the week ended May 6, 1944, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry during the week came to a total of 4,233,756,000 kw.-hr., as compared to the figure of 4,336,247,000 kw.-hr. for the week previous, which ended on April 29. Figures for the week represented an increase of 8.5 percent over the 3,903,723,000 kw.-hr. distributed during the corresponding week a year ago. The output for the similar week two years ago was lower, the total being 3,365,208,000 kw.-hr.

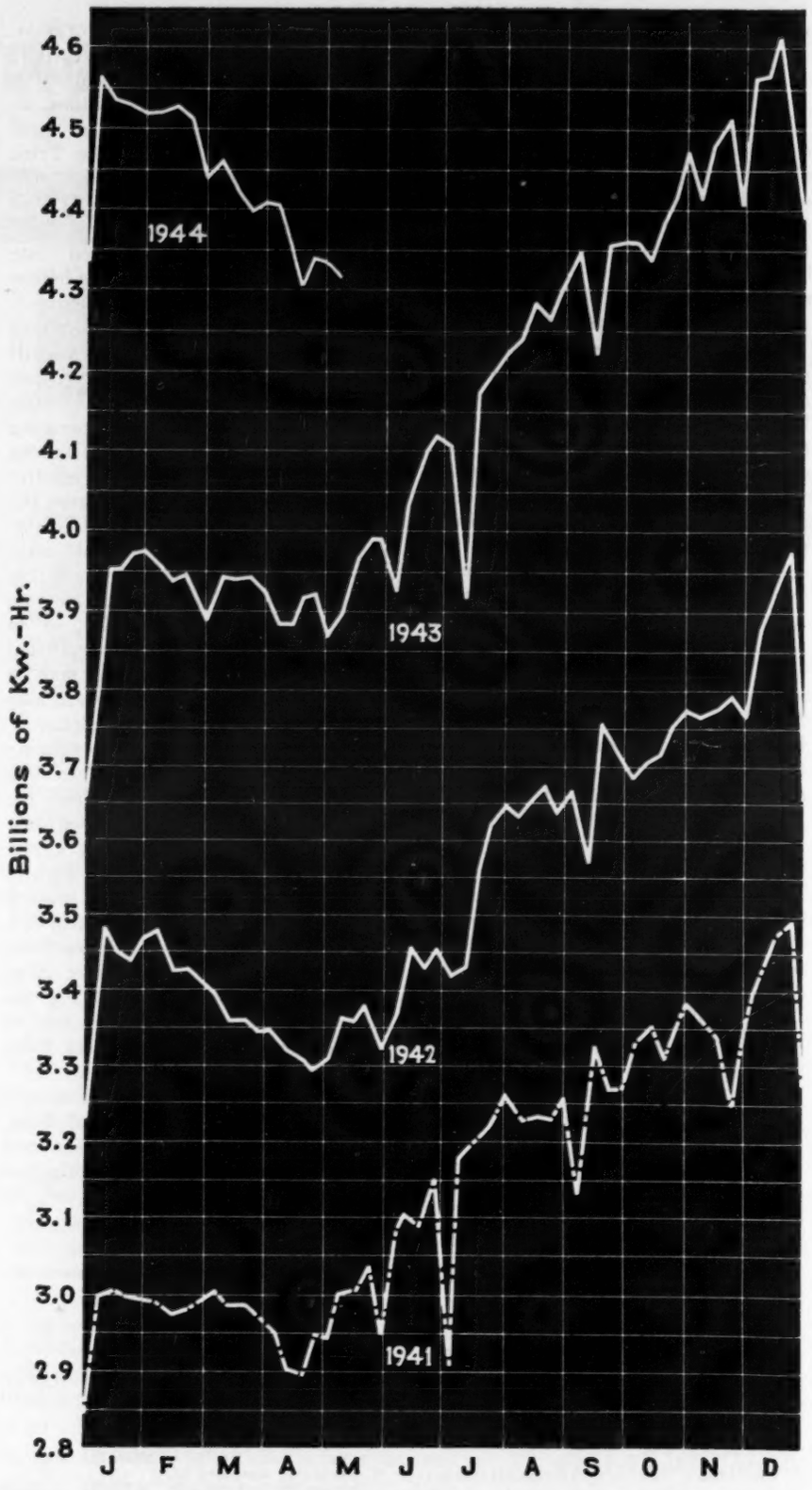
Six of the seven major geographic regions of the country reported increases for the week over the corresponding week last year, the Rocky Mountain states being the exception, reporting a decrease of 5.0 percent. The Pacific Coast region continued to lead the field with an individual gain of 20.9 percent and the Southern States regained second place with an increase of 10.4 percent. Central Industrial and West Central groups were tied for third place with a gain of 6.1 percent. Mid-Atlantic followed with an increase of 6.0 percent. New England percent increase dropped to 1.8 percent from 4.3 percent.

Weekly Output, Millions Kw.-Hr.

1944	1943	1942
May 6 4,234	May 8 3,904	May 9 3,345
Apr. 29 4,336	May 1 3,867	May 2 3,305
Apr. 22 4,344	Apr. 24 3,925	Apr. 25 3,273
Apr. 15 4,307	Apr. 17 3,917	Apr. 18 3,303
Apr. 8 4,361	Apr. 10 3,882	Apr. 11 3,321
Apr. 1 4,409	Apr. 3 3,890	Apr. 4 3,349
Mar. 25 4,409	Mar. 27 3,928	Mar. 28 3,346
Mar. 18 4,400	Mar. 20 3,947	Mar. 21 3,357
Mar. 11 4,426	Mar. 13 3,945	Mar. 14 3,357
Mar. 4 4,465	Mar. 6 3,947	Mar. 7 3,392
Feb. 26 4,444	Feb. 27 3,392	Feb. 28 3,407
Feb. 19 4,511	Feb. 20 3,948	Feb. 21 3,423

Percent Change from Previous Year

	Week Ending		
	May 6	Apr. 29	Apr. 22
New England	+ 1.8	+ 4.3	+ 3.3
Mid-Atlantic	+ 6.0	+12.9	+ 7.9
Central Industrial	+ 6.1	+ 9.5	+ 8.0
West Central	+ 6.1	+ 6.1	+ 6.0
Southern States	+10.4	+11.7	+10.3
Rocky Mountain	— 5.0	+ 2.2	+ 5.1
Pacific Coast	+20.9	+25.3	+27.0
Total United States	+ 8.5	+12.1	+10.7



Utility Wage Rate Range Set Up by Labor Board

The Fourth Regional War Labor Board in Atlanta, Ga., announced approval of contract provisions between the Virginia Electric & Power Co., Richmond, and the International Brotherhood of Electrical Workers, covering paid vacations, sick leave and holidays.

The board also established a range of wage rates for 119 job classifications of the firm, extending from 46-56 cents an hour for common labor to $1.25-$1.36 for chief meter tester, and providing a differential between rates in small and large districts.

Also approved in part was a voluntary wage application of the same company and the utility workers union, affecting an estimated 640 office employees and meter readers. The WLB approved contract provision in this case covering holidays, paid vacations, sick leave and overtime, but denied a proposed 2½ cent an hour wage increase.

Wiring Handbook Committee Formed

Sensing the wide interest of utility companies in the broad market for electrical equipment and the potential need for greater copper capacity in all classes of structures to serve the post-war market, Edison Electric Institute has been instrumental in reorganizing the Industry Committee on the Handbook of Interior Wiring Design.

Six editions of the handbook had been printed before the start of the war and it has served adequately as a "wiring bible" for architects, engineers, contractors, educational institutions and others. On the Industry Committee will serve representatives of National Electrical Manufacturers Association, International Association of Electrical Inspectors, Illuminating Engineering Society, American Lighting Equipment Association, National Electrical Contractors Association and National Electrical Wholesalers Association, in addition to representatives of E.E.I. E. A. Brand, Buffalo, Niagara & Eastern Power Corp., who was chairman of the former committee, will serve as chairman of the new committee and A. C. Bredahl, Westinghouse Electric & Manufacturing Co., Pittsburgh, is secretary.

At the first meeting in New York on May 4, it was decided to expand the committee to include representatives of the American Society of Agricultural Engineers and the American Institute of Electrical Engineers who are vitally concerned in post-war wiring developments. The committee unanimously approved the addition to the handbook of a section on farmstead wiring.

A technical subcommittee under the chairmanship of A. C. Bredahl will start immediately developing the sections on residence wiring and farmstead wiring which are considered of immediate importance.

•

OPA Consults Utility Industry on Rates

The Office of Price Administration is consulting five branches of the public utility industry to determine whether to take active jurisdiction over rates which are not regulated by states or municipalities.

The investigation, which involves consultations with representatives of the electric, gas, water, steam heating and motor carrier industries by two OPA employees, is being conducted as a result of the Supreme Court decision in the Davies Warehouse case (ELECTRICAL WORLD, Feb. 12, 1944, page 5, April 1, 1944, page 74) which reversed OPA policy by declaring that utilities so recognized and regulated by states are exempt from provisions of the Price Control Act. They are, however, still subject to the Stabilization Act of October 2, 1942, which requires 30 days' advance notice of a proposed rate increase and consent to intervene before the appropriate regulatory authority.

The OPA representative consulting with the electric and gas industries will discuss the situation with the American Gas Association, the Edison Electric Institute, Council of Electric Operating Companies, and similar organizations as well as certain of the larger electric systems. Late in March, OPA froze the situation for 60 days pending its determination of what action it should take, either to exempt unregulated utilities, to require them to report projected rate increases 30 days in advance, or to establish price ceilings in unregulated rates. The current investigation may be complete by May 23, or the freeze may be extended to allow its completion.

It is OPA's policy to disturb existing practice as little as possible. In line with this policy, OPA merely froze the situation last March and ordered only that rate increases proposed by unregulated utilities be reported 30 days in advance for a period of 60 days when it could have, under the Price Control Act, established ceiling prices on unregulated rates. These would have been in effect for 60 days, during which time the industries affected would have had to be consulted by OPA under the Price Control Act.

States which do not regulate electric rates are Delaware, Florida, Iowa, Minnesota, Mississippi, Nebraska and South Dakota. The current investigation will affect electric companies only in those states.

Utility Reports

	Net Income 1944	1943
*Alabama Power	$4,322,661	$4,530,017
*Boston Edison	5,379,119	5,209,939
*Central Hudson Gas & Elec.	1,344,465	1,513,127
*Commonwealth Edison and subs.	22,490,503	21,901,641
*Consolidated Gas, Elec. Lt. & Power (Balto.) and sub.	6,339,382	6,102,564
†Florida Power & Light	2,350,879	1,751,947
*Georgia Power	5,720,253	5,961,103
*Houston Lighting & Power	2,854,988	3,038,649
*Louisiana Power & Light	827,575	1,331,432
*Mississippi Power & Light	564,575	745,471
*New Orleans Public Service	1,681,475	2,288,493
*Philadelphia Electric and subs.	15,400,752	17,050,701
*Potomac Electric Power	4,061,766	4,080,673
*Texas Electric Service	1,776,775	1,805,526
*Texas Power & Light	2,748,444	2,144,066
*Washington Water Power and sub.	2,583,338	2,663,220

*Twelve months ended March 31.
†Twelve months ended February 29.

Must Report on War Agencies Business

Electric utilities which did more than $500,000 worth of business with any or all of six federal war agencies in a fiscal year ended between last June 30 and last March 1 will be required to file a statement of their business with the War Contracts Price Adjustment Board on or before June 1.

Also required to report by June 1 under the latest revenue act which provides for statutory renegotiation, are utilities which did more than $100,000 worth of business with any or all of the six agencies during a fiscal year ended before last June 30. Utilities which did $500,000 worth of business with any or all of the agencies during a fiscal year ended after last Feb. 29 will be required to report on or before the first day of the fourth month after the end of the fiscal year.

The six agencies are the War, Navy and Treasury Departments, the Maritime Commission, War Shipping Administration and the Reconstruction Finance Corporation. Included in the RFC are four of its subsidiaries, the Defense Plant Corporation, Defense Supplies Corporation, Metals Reserve Company and Rubber Reserve Company.

Any utilities which have previously been assigned for statutory renegotiation to any of these six agencies will report to them. Others will report to the War Contracts Price Adjustment Board, Assignments and Statistics Branch, Renegotiation Division, Room 3D573, The Pentagon, Washington 25, D. C.

One spokesman said there is a possibility that electric service contracts which actually were sub-contracts might be exempted, but that if this were the case, the subcontracts would be included in any determination of whether war business exceeded the statutory minimum for renegotiation.

There was also a possibility, according to one informed source, that the Army might be chosen as the agency to handle all electric service contracts.

•

Harry W. Hough Dies

Harry W. Hough, vice-president in charge of operations of the Cleveland Electric Illuminating Co., Cleveland, Ohio, died in that city on May 8 after a brief illness. He was 59 years of age. Mr. Hough became identified with the Cleveland utility in 1910 and has been vice-president in charge of operations since 1934.

BEFORE BUYING A TRANSFORMER

ASK YOURSELF THESE QUESTIONS

1 Can the transformer be installed indoors, at the load center, where voltage drop would be reduced and copper saved?

2 Will an indoor installation require an expensive fire-proof vault or fire wall?

3 Does the surrounding air contain impurities which might adversely affect transformer reliability and life?

4 Can lightning surges and switching transients reach the transformer, either direct or through the main supply transformer?

5 In a plant rearrangement later, is it likely that the transformer will be moved outdoors, or to some other indoor location?

6 How much maintenance will be required?

7 In an emergency, will the transformer handle sustained overloads?

8 Is there any chance that the transformer will sometime be partially or totally submerged in water?

Reg. U.S. Pat. Off.

GET THE RIGHT ANSWER WITH PYRANOL TRANSFORMERS

1 You can *safely* install Pyranol* transformers indoors. Never has one burned or contributed to a fire.

2 No vaults are required with Pyranol transformers. You can install them anywhere (even on the roof, in the basement, or on overhead beams), thus saving time, floor space, and construction materials.

3 Pressure-tight tanks protect the vital parts of Pyranol transformers from dust, dirt, fumes, dampness, and accidental damage.

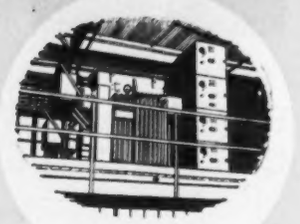
4 Pyranol transformers have high impulse strength against voltage surges—permitting dependable protection by valve-type arresters.

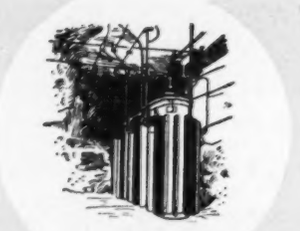
5 The completely sealed tanks of Pyranol transformers make any future change to an *outdoor* installation "a natural." Their inherent safety makes it possible to relocate them *indoors* anytime, anywhere.

6 Because dust, dirt, and moisture can't get into a Pyranol transformer, and since Pyranol is nonoxidizing and nonsludging, little or no maintenance is necessary.

7 The heat-storage capacity of the core-and-coils and of the cooling liquid make the Pyranol transformer ideal for sustained emergency overloads.

8 Pyranol transformers are pressure-tight. Even after three days' submersion in a torpedoed tanker, Pyranol transformers were found unharmed.





ALL-PURPOSE

PYRANOL TRANSFORMERS

For further information ask your G-E representative, or write for Bulletin GES-2974. *General Electric Company, Schenectady, N. Y.*

BUY WAR BONDS

GENERAL ELECTRIC

HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

Rope Resistance Confirms Cautions

Utility companies' often expressed precautions against the handling of ropes in electrically hazardous areas are justified by measurements recently made by Francis L. Hermach of the National Bureau of Standards. The test conditions and results obtained are here tabulated; the letters RH and T in the table denote relative humidity and temperature, respectively, of the air bath used.

Test Condition	Resistance in megohms per foot of length
A. New rope	
(1) In air at RH-20%, T-20° C.	300,000
(2) In air at RH-45%, T-25° C.	6,000
(3) In air at RH-95%, T-35° C.	40
B. Rope soaked in tap water for 5 minutes	
(1) Surface wiped dry...	4
C. Rope soaked in tap water for 2 days	
(1) Surface wiped dry...	0.2
D. Rope soaked in sea water for 2 days	
(1) Surface wiped dry...	0.01
(2) Dried in air at RH-30%, T-25° C....	20,000
(3) In air at RH-95%, T-35° C.	0.2

Measurements were made of the longitudinal resistance of clean, new samples of manila and sisal hemp, cotton and jute ropes ½-in. and ¾-in. in diameter, using direct current at voltage gradients up to approximately 1,000 volts per linear foot of rope. The electrode consisted of copper wire tightly wrapped around the rope at the desired lengths. No appreciable contact resistance was observed for these electrodes. Before each measurement, each sample was conditioned in an air bath of the desired relative humidity and temperature simulating dry, average and tropic conditions until equilibrium was reached.

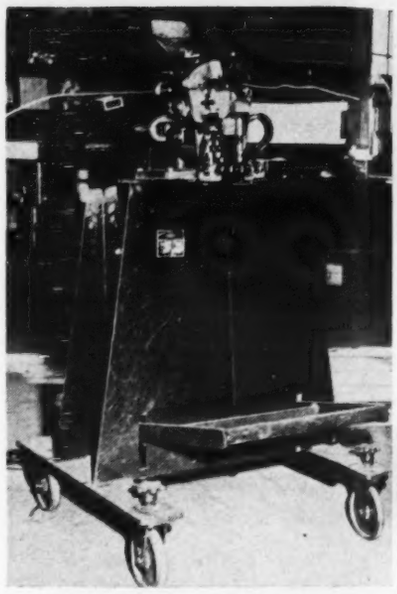
Measurements which were made demonstrate that the resistance of each rope tested was greatly dependent upon the ambient relative humidity. The results also show that for the same ambient condition the resistance was not greatly dependent upon the particular fibre used. With two exceptions, the resistance of any one of the samples did not differ from the geometric mean of the resistances of the nine samples tested under the same ambient condition by more than a factor of 10; for these two, the factor was less than 15. This is much less than the factor introduced by changing atmospheric conditions, as is evident from the table, and because of this a more complete study of samples did not seem justified. Each value of the resistance given in the table is the geometric average of the resistances of the nine samples for the given test condition.

It is important to note that all these measurements were made on clean, new ropes. The resistances of such ropes would undoubtedly be considerably reduced by the contamination, loss of lubricant, and absorption of salty perspiration resulting from even a short period of ordinary use.

•

Welder Aids Wire Salvage

In salvaging scrap copper wire, the Washington Water Power Co., Spokane, Wash., uses the electric welding machine shown, which was purchased especially for the purpose. After grinding off the burrs left by the electric butt weld, the wire is electrically annealed and redrawn, usually to No. 6 size. With the electric welder it has been found to pay to use up scrap



pieces as short as 5 ft. The whole remanufacturing process will handle gages up to size 1/0, and is done in spare time of the warehouse attendants.

•

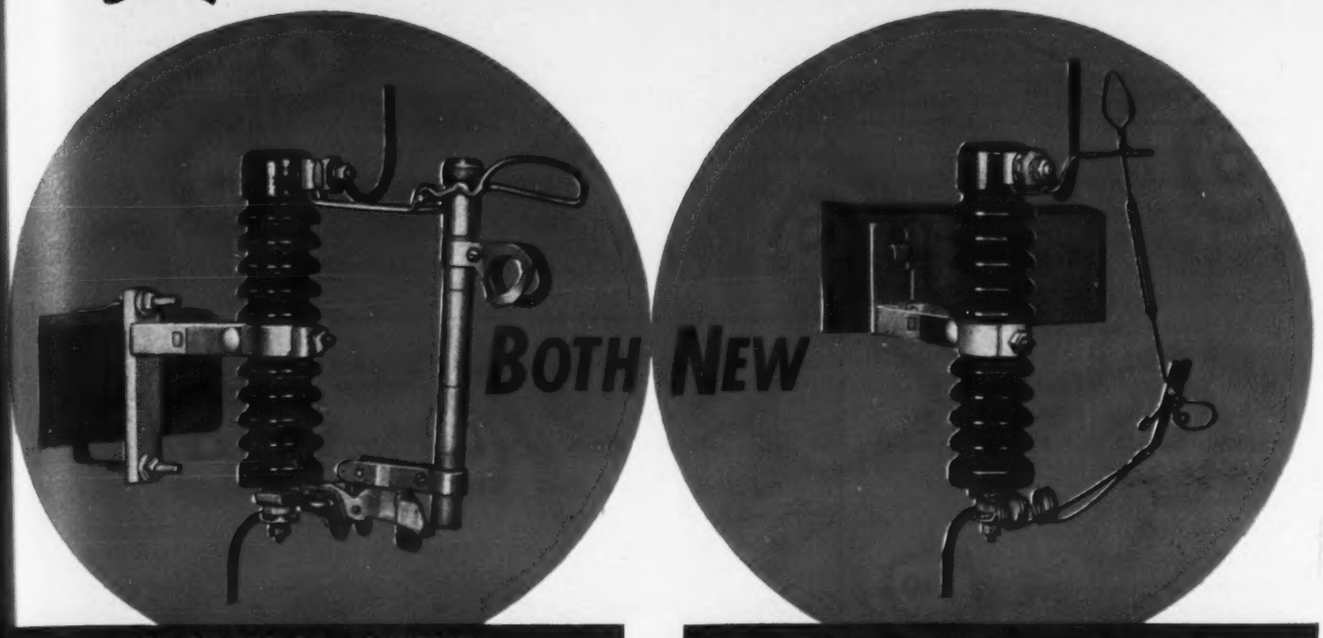
Concrete Promising for Manhole Covers

By RUSSELL COLE
Underground Department
Detroit Edison Co., Detroit, Mich.

Recent experience with reinforced concrete manhole covers installed on an experimental basis at points on the Detroit Edison Company system reveals that these substitute covers stand traffic well, that life expectancy—based on present limited experience—may approach five years, and that from a cost standpoint they are competitive with malleable iron covers.

Concrete covers conforming to the illustrated design were developed in

NOW YOU HAVE A CHOICE OF 2 G-E OPEN-TYPE CUTOUTS



OPEN FUSE CUTOUT
with drop-out fuse holder

This new G-E cutout (50- and 100-amp ratings for 7500/12,500-Gr-Y and 15,000-volt circuits) combines the operating, safety, and convenience features of the hinged-fuse-holder, drop-open type in a modern construction possessing the following important features:

INTERCHANGEABLE FUSE HOLDERS, on 50- and 100-amp cutouts of same voltage rating, reduce your stock requirements.

SOLID-PORCELAIN INSULATOR, with undercut petticoats, provides dependable insulation and mechanical strength.

RECOIL-PROOF FUSE HOLDER cannot be unseated by recoil forces during operation; an automatic latch locks it on the hinge until the fuse holder drops open.

TIME DELAY of hinge toggle keeps contact arms in closed position until the arc is cleared within the fuse holder.

SILVER-PLATED CONTACTS and contact arms assure permanently low resistance of contacts.

FLIP-OPEN FUSE CUTOUT

This new cutout, of the open type but without fuse holder, is specially designed for light-duty circuits, and where the operating advantages of the hinged-fuse-holder design may be considered unnecessary. It is available in 50-amp ratings for 7500/-12,500-Gr-Y and 15,000-volt circuits. Some of its more important features:

SPRING-CONTACT ARMS of strong, resilient Copperweld steel assure adequate tension on fuse link and positive separation of blown fuse link when fault occurs.

SOLID PORCELAIN INSULATOR same as that used in hinged-fuse-holder design.

CONTACT ARMS are attached to the top and bottom of the porcelain insulator in such a way that fixed alignment is assured and side vibration prevented.

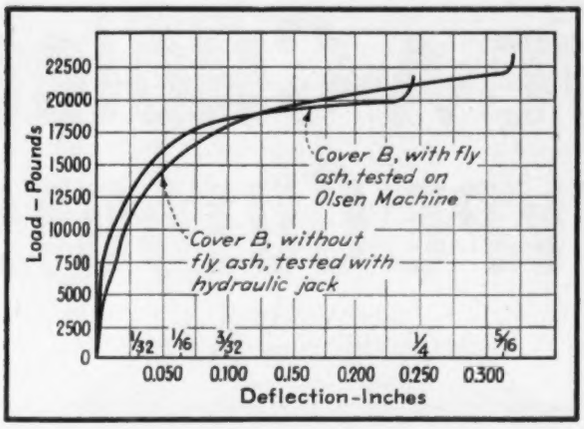
RING at each end of fuse link makes the link easy to remove with a switch hook.

SIMPLE CONSTRUCTION; low cost.

BUY WAR BONDS

Both cutouts provide positive visual indication of outages; both are easy to fuse. They can be serviced with any standard switch hook. Only a careful study of your particular application will determine which cutout is best suited for your job. Write for Bulletins GEA-1816 and GEA-4224. *General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC



LOAD DEFLECTION TEST CURVES for concrete manhole covers undergoing service tests in Detroit

Detroit when the supply of standard malleable iron covers was dwindling due to the war. Tests showed that such covers were capable of standing a load in excess of 17,500 lb. with a center deflection of 0.1 in.

Accompanying load - deflection curves indicate that elasticity of the covers has a remarkable similarity to that of steel covers. These tests were obtained on two covers, one of which had fly ash incorporated in the mix; the other none. The tests indicate that at smaller deflections the mix in which fly ash was used develops slightly greater strength than the other.

Mix used in covers now undergoing service test uses fly ash. The concrete material for one cover having a volume of 1.1 cu.ft. is listed in Table 1 below.

The concrete is required to develop 5,000 lb. compressive strength at 28 days.

The concrete is vibrated and steam cured under a pressure of 100-125 lb.

TABLE 1

Cement	24.9 lb.
Sharp sand	50.3 lb.
½ in. stone	71.1 lb.
Fly ash	5.1 lb.
Water	13.4 lb.

TABLE 2

	Heating Period to 350 Deg. F., Hours	Constant Temp. Period at 350 Deg. F., Hours	Cooling Period, Hours
Ideal range	5	9	10
Allowable range	3-6	5-10	6-15

TABLE 3

9 ft. 2½ in. of ¼-in. bar at 0.167 lb. per ft. (lb.)	1.54
14 ft. 7½ in. of ⅜-in. bar at 0.372 lb. per ft. (lb.)	5.45
8 ft. 3 in. of 1 x 1 x ⅛-lb. angle at 0.80 lb. per ft. (lb.)	6.60
No. 9 gage wire and welding rod (lb.)	2.75
One 3/16 x 4-in. dia. steel plate (lb.)	0.66
Total (lb.)	17.00

according to Table 2.

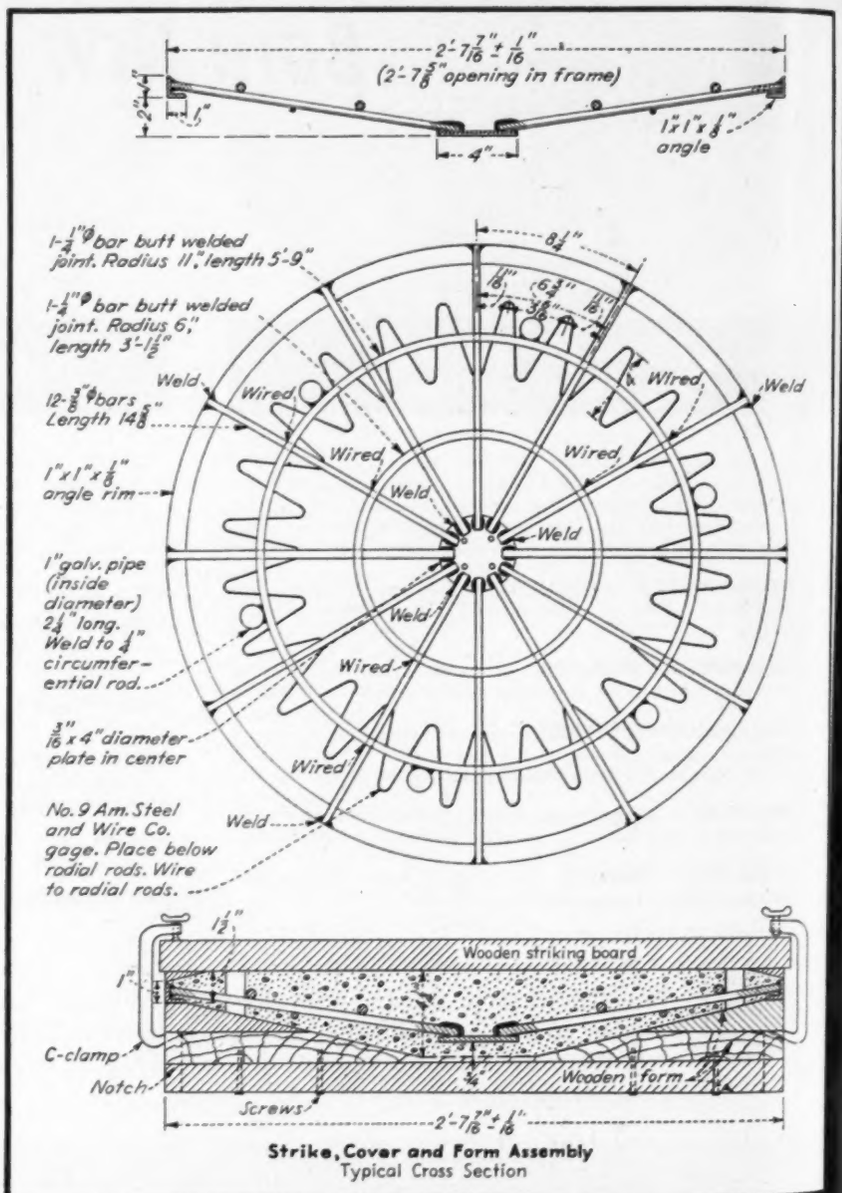
Steel and reinforcing material used in one cover totals 17 lb. and includes the various items listed in accompanying Table 3.

Total weight of the concrete cover is 160-165 lb., which is within the same range as the comparable standard malleable iron cover.

Reinforcing for the cover consists of a steel spider made up as shown in the accompanying drawing. It is made up of an angle iron outer ring with twelve ⅜-in. steel spokes welded to it and to a 4-in. diameter steel "hub plate" at the center. Two concentric rings of butt-welded ¼-in. bar are wired to the spokes at 6 and 11 in. radius. Zigzag wire is fastened to the outer concentric ring as further reinforcing.

Particular care had to be exercised in assembling the spider that the spokes are firmly welded to the outer angle iron ring and the center plate. If this is not done the spokes will snap free under load.

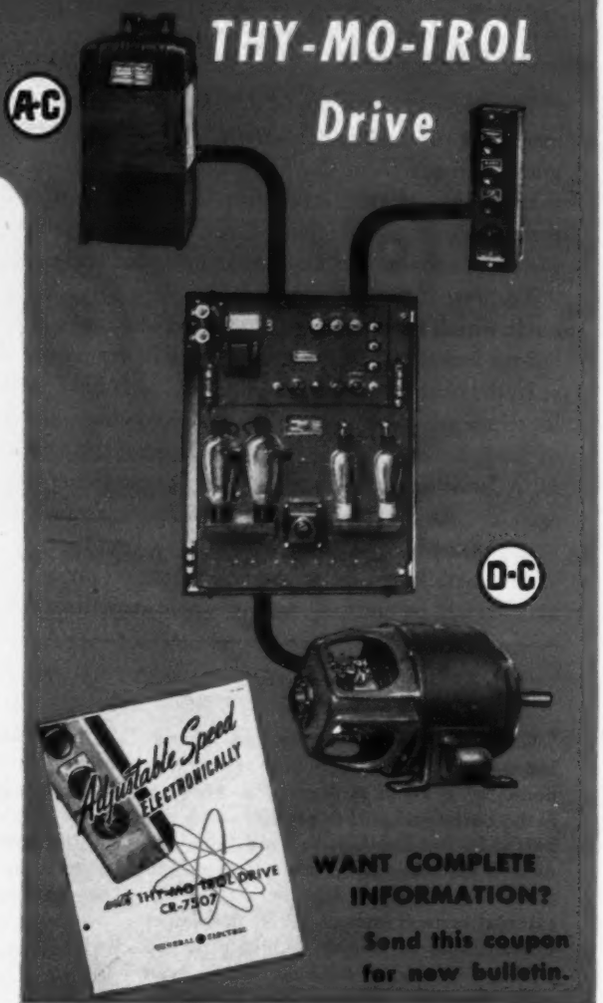
At present 19 experimental covers are located in heavy traffic areas, six in streets surrounding company offices, thirteen on roads within company property. Cost of the concrete cover is 90-95 percent of the standard malleable iron cover.



EXPERIMENTAL MANHOLE COVERS of reinforced concrete design offer promising substitute for malleable iron covers

CONSTANT SPEED EVEN WITH CHANGING LOADS

--ANOTHER Advantage of THY-MO-TROL Drive



What it means to machine users

MAINTAINED PRODUCTION because the speed of the motor does not fall off appreciably as the load on the machine increases.

IMPROVED QUALITY OF WORK because Thy-mo-trol drive provides the *correct operating speed,* and holds it.

NEED FOR GEAR CHANGING OFTEN ELIMINATED because Thy-mo-trol drive makes possible a wide speed range—ratios of 100:1 or greater can be provided.

ACCURATE SPEED CONTROL. Speed is held constant at the level the operator selects for each operation needed.

Standard Thy-mo-trol drives hold speed very closely, even though the load varies from no load to full load, because the electronic circuits automatically compensate for the voltage drop within the motor (which varies according to the load). For example, if the compensation adjustment is set for flat speed regulation at 10 per cent of basic speed, the regulation will be within 2 per cent when the drive is operated at basic speed (assuming constant motor temperatures).

When regulation better than that provided by the standard Thy-mo-trol drive is required, the addition of a tachometer generator affords speed regulation within one-half of 1 per cent.

A COMPLETE DRIVE. Thy-mo-trol drive takes a-c power from your supply line and, through its d-c motor, delivers torque to your load over a wide range of speeds. Starts, accelerates, controls speed, stops by dynamic braking, and reverses the motor—all from a single control station.

Standard drives can be obtained in ratings from 1/8 to 15 hp—higher or lower if needed.

HOW TO BUY THY-MO-TROL. Just give our local office complete information about your requirements—nature of the load, speed range, horsepower, etc. Then, our engineers will select just the right Thy-mo-trol drive components, to give you exactly the operating characteristics you want.

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WANT COMPLETE INFORMATION?

Send this coupon for new bulletin.

General Electric Company, Section J668-14
Schenectady 5, N. Y.

Please send me a copy of Bulletin GEA-4025, which tells what Thy-mo-trol drive will do, what it has done, and how it works.

Name .....

Company .....

Address .....

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8930

STRESS CALCULATIONS FOR POLE LINE STRUCTURES—I*

By CARL G. ERICKSON, Electrical Engineer, Northern Indiana Public Service Co., Hammond, Ind.

Purpose of this series of articles is to refresh the designer's mind with such essentials of stress calculations as will permit him to eliminate much of the guess element from the design of various wood pole transmission structures used in lieu of steel structures. An analysis of stresses set up in the various members of wood pole structures will often furnish the engineer with the basis for more economical and better designed transmission lines.

To present the subject in as simple a form as possible, assumptions will be made which favor the easiest method of stress calculation. In general the calculations based on these assumptions will err on the side of safety.

In the examples given, all applied loads have been arbitrarily chosen and the locations of the planes of contraflexure have not been calculated. Some types of loads have been omitted; all to permit the essential methods to be presented in as brief and simple a manner as possible. The designer will learn to add certain refinements which will make possible more accurate stress computations than outlined.

This article presents stress calculations for a single wood pole. Subsequent articles will be on two- and three-pole structures with various forms of bracing.

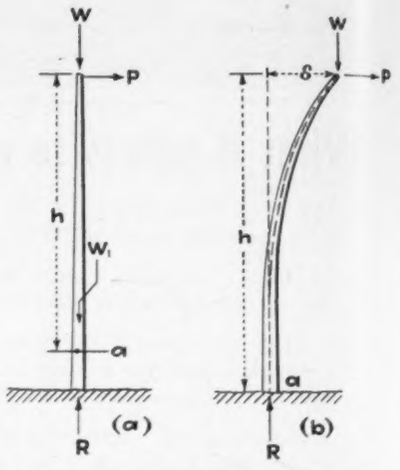


Fig. 1—Basic load diagrams for (a) a single pole and (b) a single pole deflected

Single Pole

Consider a pole as in Fig. 1(a). Bending moment M_a in foot pounds, about any point "a" is given as $M_a = Ph$, where P is the horizontal pull in pounds and h the height in feet between "a" and the point of load application. Vertical reaction R in pounds equals $W + W_1$, where W equals external vertical load and W_1 is the weight of pole, both in pounds. If in addition to P there is a wind load on this tapered pole, bending moment M will be increased by an amount:

$$M_w = P_1\left(\frac{D+2d}{2}\right)\frac{h^2}{3}$$

where P_1 equals horizontal wind pressure on the pole in pounds per square foot, D the diameter of the pole in feet at "a", and d the diameter of the pole top, in feet.

In the following discussions, wind load on the pole is neglected. Wind load on pole may be added by assuming that the wind load is proportionately concentrated at the brace joints. Consideration then must be given to these added loads when determining the horizontal and vertical reactions and forces at the brace joints.

Where load P is large and the earth setting is substantial enough so that the earth will not rupture it may be well to take into account the increased bending moment about "a" caused by the vertical load W and deflection δ, see Fig. 1(b). This additional bending moment is $W\delta$, where:

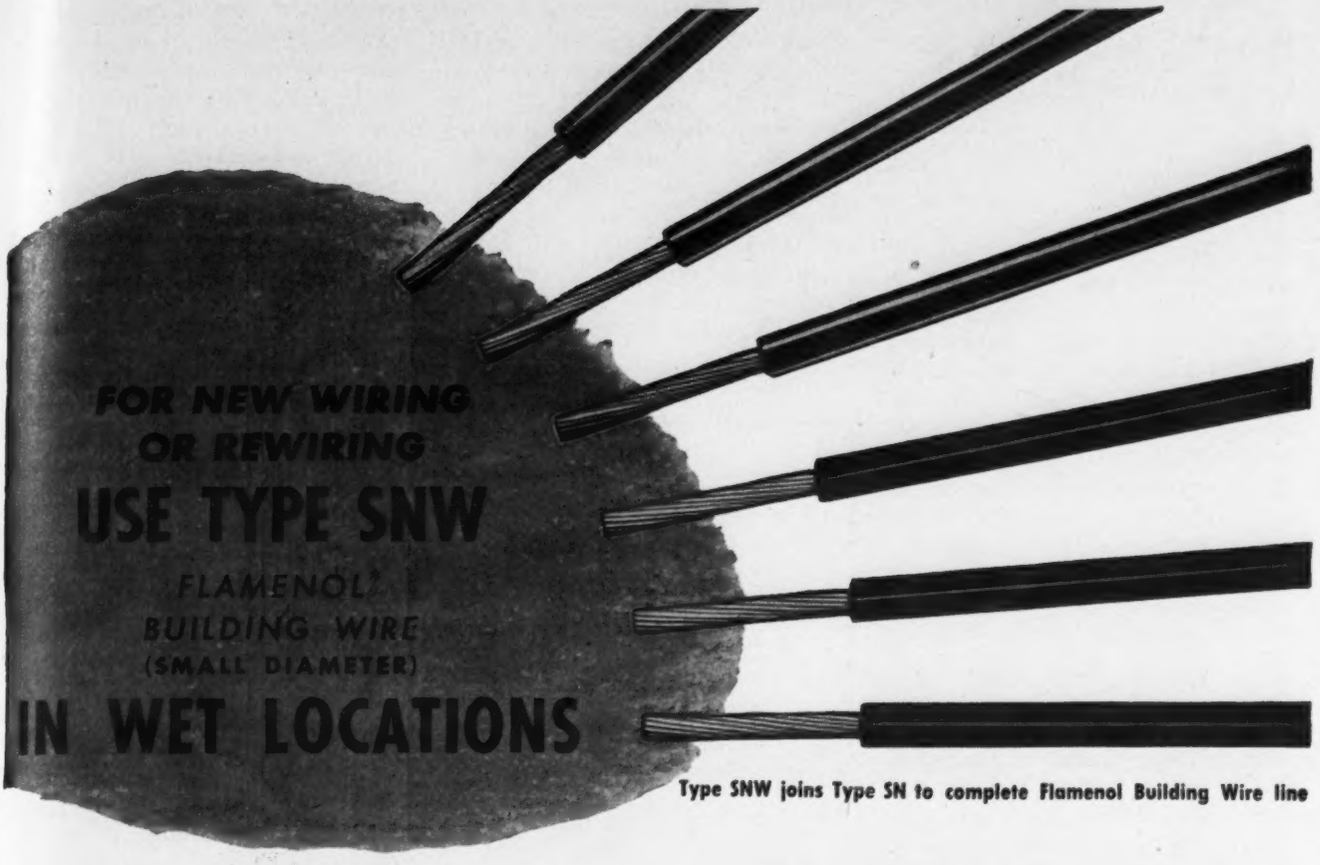
$$\delta = 0.0471\frac{Ph^3}{E\,D^3\,d}$$

E is the modulus of elasticity of the pole material, D the diameter of the pole in feet at point "a" and d the diameter of the pole in feet where load P is applied. The additional deflection caused by load W is neglected here because it is unusual for it to be of such magnitude to cause any appreciable difference.

Braced Poles

For single poles M_a is usually calculated for point "a" at the ground line, for point "a" located where the pole diameter is one and one-half times the diameter at P, and for points on the pole where guys or struts are attached. For braced pole structures, bending moments should be calculated about all joints on the pole formed by the pole and brace ends as well as at the ground line for loads or forces at the planes of contraflexure.

* First in a series of six articles.



Type SNW joins Type SN to complete Flamenol Building Wire line

Here is the ideal wire to use in raceways in wet locations in your plant for new wiring or rewiring. Its small diameter and smooth finish make it easy to install. It can be depended upon to give long service. It is approved by the Underwriters' as listed in the 1940 N.E.C. in sizes 14 to 4/0 inclusive for use in raceways as follows:

1. Underground
2. In concrete slabs or masonry in direct contact with the earth
3. In wet locations
4. Where the condensation and accumulation of moisture within the raceway is likely to occur.

Whole wiring systems can now be made up of Flamenol Building Wire using Type SNW Flamenol wire for wet locations and standard Type SN Flamenol wire for dry locations. The thermo-plastic insulation of both wires has long life, is high in dielectric and mechanical strength and resistant to oils, acids and alkalies. In addition, the insulation of Type SNW Flamenol wire has low moisture absorption.

**Reg. U.S. Pat. Off.*

★ **BUY WAR BONDS** ★

G-E BUILDING WIRES, TYPE R and TYPE RH

G-E Type R, Code grade and Type RH, Heat Resistant grade building wires are also available. These building wires are insulated with synthetic rubber. They are carefully made and will give good service.

★ ★ ★

For further information on Flamenol Building Wires, Type SNW and Type SN or on building wires Type R and Type RH, see the nearest G-E Merchandise Distributor or mail the coupon.

Hear the General Electric radio programs: "The G-E All-girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M. EWT, CBS.

GENERAL ELECTRIC

General Electric Company
Section W541-9
Appliance and Merchandise Dept.
Bridgeport, Conn.

Sirs: Please send me information on ☐ Flamenol Building Wires, Type SNW and Type SN or on ☐ G-E Type R and Type RH Building Wires.

Name.....

Address.....

City..... State.....

How To Select Tap On Bushing C. T.

By F. A. OLMSTED,
Electrical Engineer, Mill and Marine Electric, Inc.,
Gastonia, N. C.

A slide-rule method has been developed to select the proper current tap on bushing-type current transformers when used in conjunction with bar-type current transformers for differential relay protection. This applies where the power transformer bank is delta-wye connected. The current transformer connections, ratios, and capacities are based upon the rating and connections of the apparatus involved.

This method eliminates the necesstiy of calculation by the formula:

$$I_t = \frac{I_p}{R_T} \times \frac{I_{MCT}}{R_{MCT}} \times \frac{1.73}{i_s}$$

where I_t = ampere tap on the multi-ratio bushing current transformer, and the other symbols represent the items shown in Fig. 2.

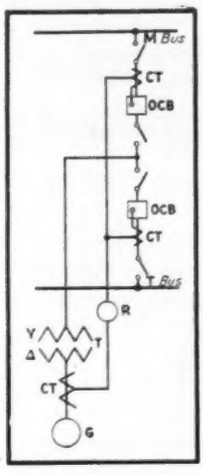


FIG. 1—Single-line connection diagram for generator and power transformer connected by oil circuit breakers to main and transfer buses, including differential relay protection

Referring to Fig. 1 showing typical connections, the generator and power transformer bank are operated as a unit, with the transformer bank connected through oil circuit breakers to the main and transfer buses. With that connection there is a phase displacement between the delta and wye sides of the transformer bank, which is corrected by wye connecting the current transformers on the delta-connected side of the power bank and delta connecting the current transformers on the wye-connected side of the power bank.

Current transformers between the generator and power transformer are generally the bar- or through-type. In recent practice for main and transfer bus schemes where large oil circuit breakers are required it is economical to specify oil circuit breaker bushing-type current transformers.

In selecting the correct ratio for the current transformers the first two steps are to determine the generator current rating output and the transformer ratio. Assuming a generator is rated 33,333 kw., 1.0 p.f., 13,200 volts, 3-phase, 60 cycles, and the step-up transformer is rated 13.2 kv on the low side and 132 kv on the high side, then

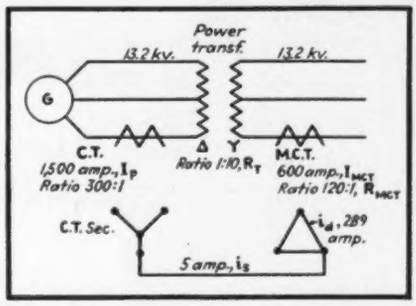


FIG. 2—Schematic diagram and designations of transformers

$$\text{Amperes per phase} = \frac{33{,}333}{1.73 \times 13.2} = 1400$$

$$\text{Transformer ratio} = 13.2 : 132 = 1:10$$

An accompanying table lists standard current transformer ratings. For this specific solution the nearest rated indoor dry type current transformer is 1,500 amp. The next step is to select the primary rating or tap for the bushing-type current transformer, so that the secondary currents of both transformers are equal.

At this point the slide rule is used as a substitute for the formula. Move the glass runner so that the hair line is over 1.73 on the right hand side of scale A. Opposite 1.73 on scale A set the transformer ratio 10 on scale B (approximately center). Move the glass runner to 1,500 on the left of scale B and read the bushing current transformer primary rating or tap 259 on scale A. Then referring to the table for bushing type transformers the nearest tap is 250 amp. ratio.

Current Transformers Types and Ampere Ratios

Indoor Dry Type (Standard Commercial Ratings) Ampere Rate	Oil Circuit Breaker Bushing Type (NEMA SG6-50) 600-amp. Multi-Ratio Approx. Amp. Ratio
1000 to 5	50 to 5
1200 to 5	100 to 5
1500 to 5	150 to 5
2000 to 5	200 to 5
2500 to 5	250 to 5
3000 to 5	300 to 5
4000 to 5	400 to 5
5000 to 5	450 to 5
6000 to 5	500 to 5
8000 to 5	600 to 5

For other primary ratings for the same power transformer ratio, without changing the slide rule setting, move the glass runner to 2,000 on scale B and opposite read 346 on Scale A; to 2500, read 433; and to 3,000, read 519.

•

How to Maintain Fire Extinguishers

By H. P. QUADLAND
Safety Research Institute, New York, N. Y.

Practically the entire present production of the fire extinguisher industry is allocated to the armed forces and to war plants with top priority ratings, so that maintenance of this equipment is of special importance at this time.

With proper care, standard fire extinguishers approved by Underwriters' Laboratories and Factory Mutual Laboratories will remain in excellent operating condition indefinitely. Maintenance procedure to prolong their utility is based upon the following general rules.

1. Appoint one man (or more if required) who is, or will become, familiar with the various types of equipment, and charge him with responsibility for its inspection, recharging and general maintenance.

2. Careful inspection of extinguishers should be made at approximately monthly intervals, to make certain they are filled, are in good operating condition, and have not been tampered with or damaged by blows or falling.

3. Suspicious looking extinguishers should be recharged immediately. (Vaporizing-liquid extinguishers have been found filled with gasoline. To detect such malicious tampering, pump a few drops of the contents into a receptacle and test for odor and flammability.)

4. Recharge extinguishers as soon as they are used, following the directions for each type and using materials and spare parts obtained from the manufacturer of the equipment. The date of the recharge should be marked on a tag attached to each piece of equipment. Soda-acid and foam extinguishers require annual recharging, if they have not been used in the meantime.

5. On the stored-pressure vaporizing-liquid extinguisher, the pressure

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gauge should be checked. If low, the pressure can be brought up to normal with the extinguisher air pump or from a service air line. The liquid level also should be noted and additional liquid added as required.

6. Examine extinguisher nozzles. Where obstructed they can be cleaned out with a piece of wire. Incidentally, make certain that the nozzles of soda-acid and foam-type extinguishers are not interchanged.

7. Repairs to damaged extinguishers are best not attempted. They should be sent to their manufacturers for skilled reconditioning. Approved fire extinguishers are carefully balanced and specially designed, and they should not be tinkered with.

8. Good maintenance requires keeping the equipment in its proper place, usually on a special panel board approximately at eye level, where easy access to it is not obstructed and where it is not subject to damage by workmen or hand trucks.

These rules are fairly simple and, if carefully observed, will assure long life for the extinguisher and an efficient weapon when needed.

•

Inexpensive Interruptor Replaces O.C.B.

A novel piece of apparatus to be used as a medium for deenergizing an unloaded transformer or line has been developed by the Adelaide Electric Supply Co. of Adelaide, Australia. As reported in "The Adelect," it consists of a modified liquid-fuse wherein the fuse element has been removed and an external catch has been substituted for the strain wire. To load this interruptor a loading rod is inserted into the liquidless fuse shell extending the spring until the end or cap of the spring protrudes from the end; then the catch is engaged to hold the spring under load and the rod is withdrawn. The cap is fastened over the end and the interruptor is ready for the circuit.

When a line or transformer is to be deenergized a set of three interruptors is taken to the site, and one is inserted in each of the previously provided mountings, thus paralleling the existing fuses or disconnects. The fuses are then drawn or the disconnects opened; this leaves the circuit alive by the way of the interruptor.

By tripping the catch with a switch stick and releasing the spring, the circuit is opened. The arc is confined within the glass walls of the interruptor. It is reported that this device will safely interrupt the magnetizing current of transformers or the charging current of a short transmission line.

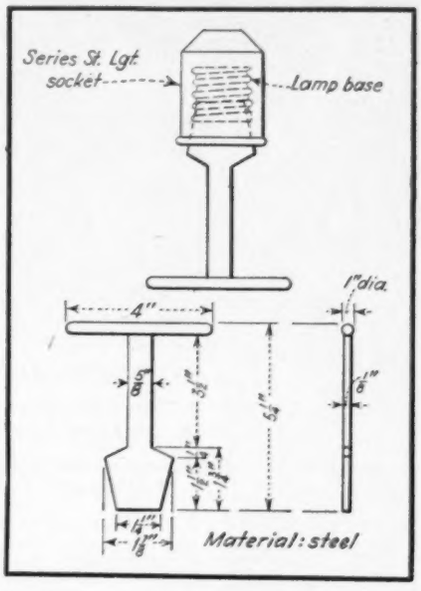
The tongs used to insert the interruptors in the duplex contacts are attached to a 15-ft. pole, are adjustable to angles up to 45 deg., and are closed and opened by means of a screw rod extending through the handle.

•

Simple Street Light Base Extractor

By GEORGE I. WILSON
Pacific Gas & Electric Co.,
Sacramento, Calif.

Considerable difficulty is experienced in removal of lamp bases from series street lighting fixtures when the lamp is broken. About 20 percent of the lamps break when removal is attempted, due to corrosion and recently to excessive heat brought about by use of dimout shields. Bases have been removed with pliers, a difficult and lengthy job.



DETAILS of series lamp-base extractor made from piece of ⅛ in. flat steel

To overcome this difficulty a lamp base extractor has been devised, as shown by the sketch, which will readily remove the lamp base under any conditions. The tool is made of ⅛-in. flat steel with steel handle. It requires very little material and is inexpensive to make. The tool has been thoroughly tried out and has proved entirely satisfactory.

•

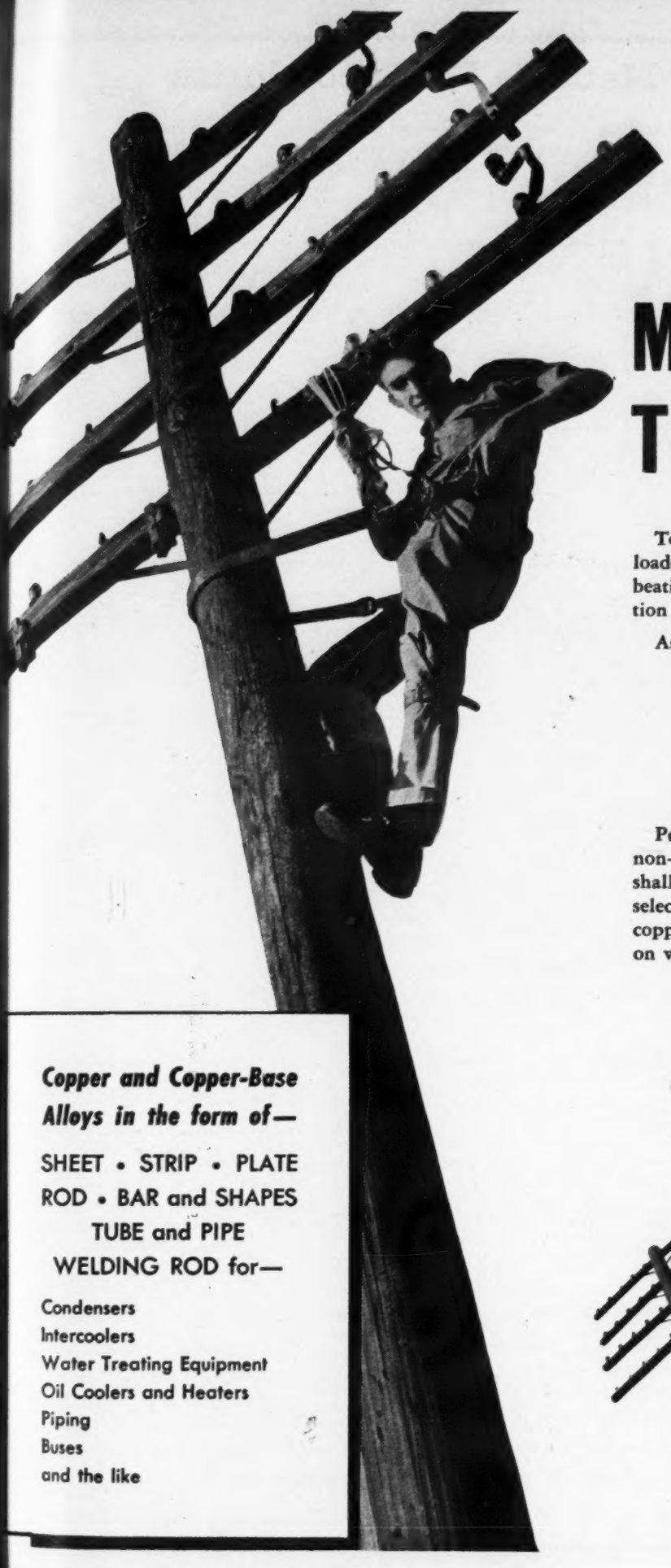
Benefits Obtained from Silverplating Contacts

Benefits obtained from silverplating contacts are presented in a recent paper as a result of a survey by W. C. Bowen of West Penn Power Co. for the Electrical Equipment Committee of Pennsylvania Electric Association. The report states that one company increased capacities up to 100 percent as a result of the application of silver contacts on the disconnect contacts and O.C.B. contacts. This type of contact is universally used where large strap copper bus connections are made, which practice has improved to a great extent the contact voltage drop at these connections.

Another company stated that on a 1,200 amp. capacity breaker it was found that at 1,200 amp. the contact temperature rise above room temperature was 75 deg. C. as the breaker came from service. After cleaning and adjusting this was reduced to 45 deg. C., and a further reduction to 39 deg. C. was obtained by silverplating the contacts and minor ventilation improvements.

Still a third company cites a case where a 4,000 amp. capacity 12 kv. breaker was found to have 434, 950 and 2,100 microhms contact resistance per phase. After silverplating these resistances dropped to 1.5, 1.5 and 1.7. One year later these were found to be 2.3, 1.8 and 2.8. On another breaker values of 590, 890 and 260 were reduced to 2.5, 3, and 2.5 by silverplating and one year later this was found to be 6, 6 and 7. These breakers operated at temperature rises exceeding 30 deg. C. before silverplating; since plating the temperature rise is approximately 10 to 15 deg. C. The breaker tanks are now cool where before they were uncomfortably hot to touch.

There is also mentioned in this paper the fact that there are two methods of applying the silver plating; that is by brush and by electric process. Results with the electric process, according to the paper, were faster and less messy than with the brush.



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Grounding Methods For Secondaries

Three methods for grounding lightning arresters and secondaries, also four methods for making single, multiple, and treated grounds at foot of wood poles; adapted from line construction standards of The United Illuminating Company, New Haven, Conn.

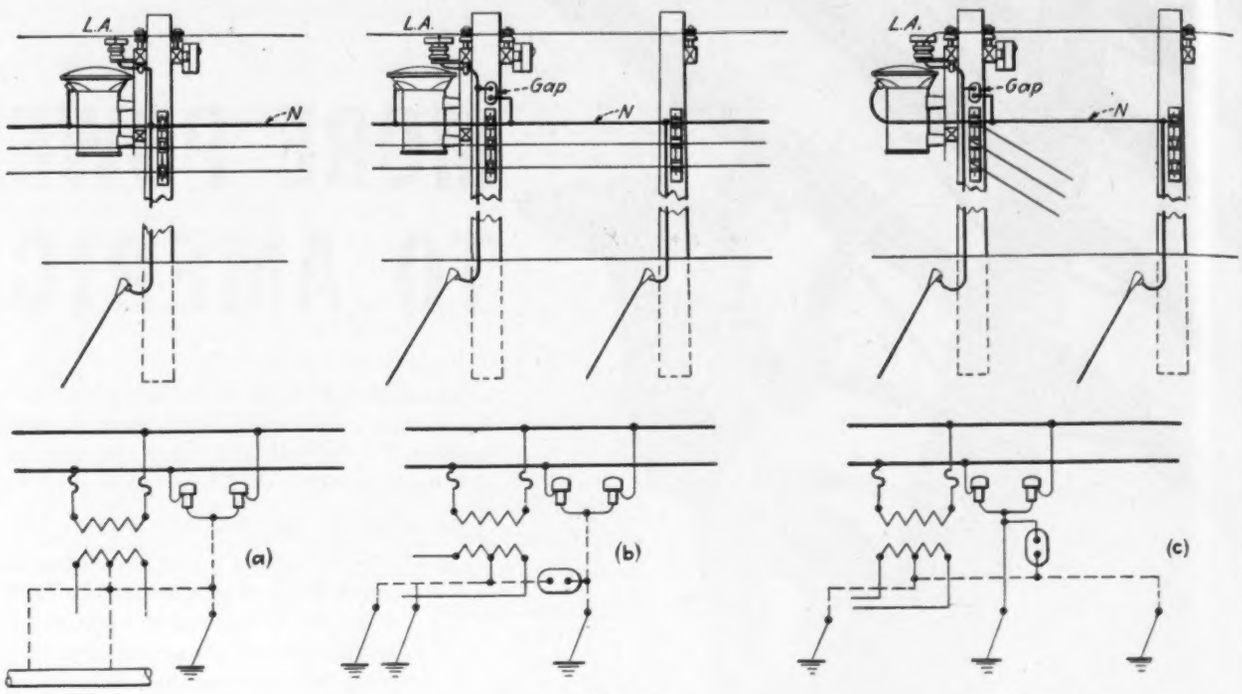

FIG. 1 (above)—(a) Two or more services with water pipe grounds. (b) Two or more services with driven grounds. (c) Single service lightning arrester ground at transformer pole and neutral at next pole. Grounds are interconnected; latter two through gaps

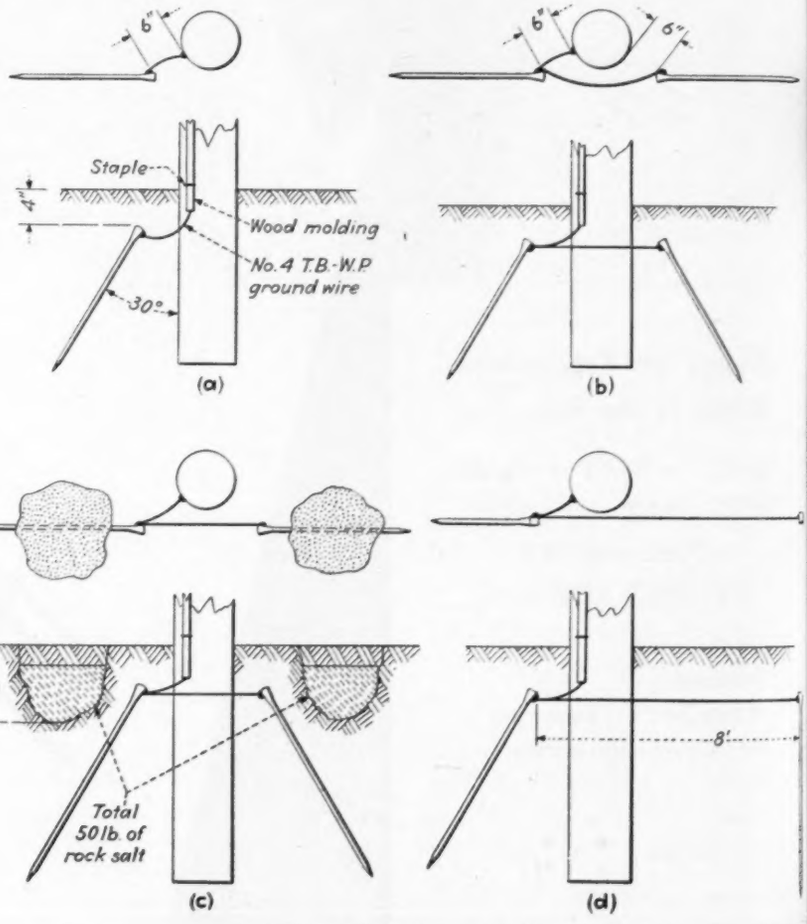

FIG. 2 (right)—Driven grounds at foot of wood pole: (a) single, (b) and (d) multiple, and (c) treated

When the measured resistance of a driven ground rod exceeds 15 ohms, a second ground rod shall be installed. The second rod shall be at least 8 ft. away from the first rod where practical, otherwise, the second rod shall be driven on the opposite side of the pole and pointing in the opposite direction from the first ground rod. These ground rods shall be connected together.

If the combined resistance of these two rods still exceeds 15 ohms, 25 pounds of rock salt shall be placed in a basin scooped out around the top of each rod to a depth of about two feet. The salt shall be moistened before the basin is back-filled. Care should be taken to keep the salt away from the wire connection to the top of the rod.

Ground wire shall be run on the side of the pole away from traffic.

ese Basic advantages and performance characteristics are

und only in L-M ROUND-WOUND

ISTRIBUTION TRANSFORMERS

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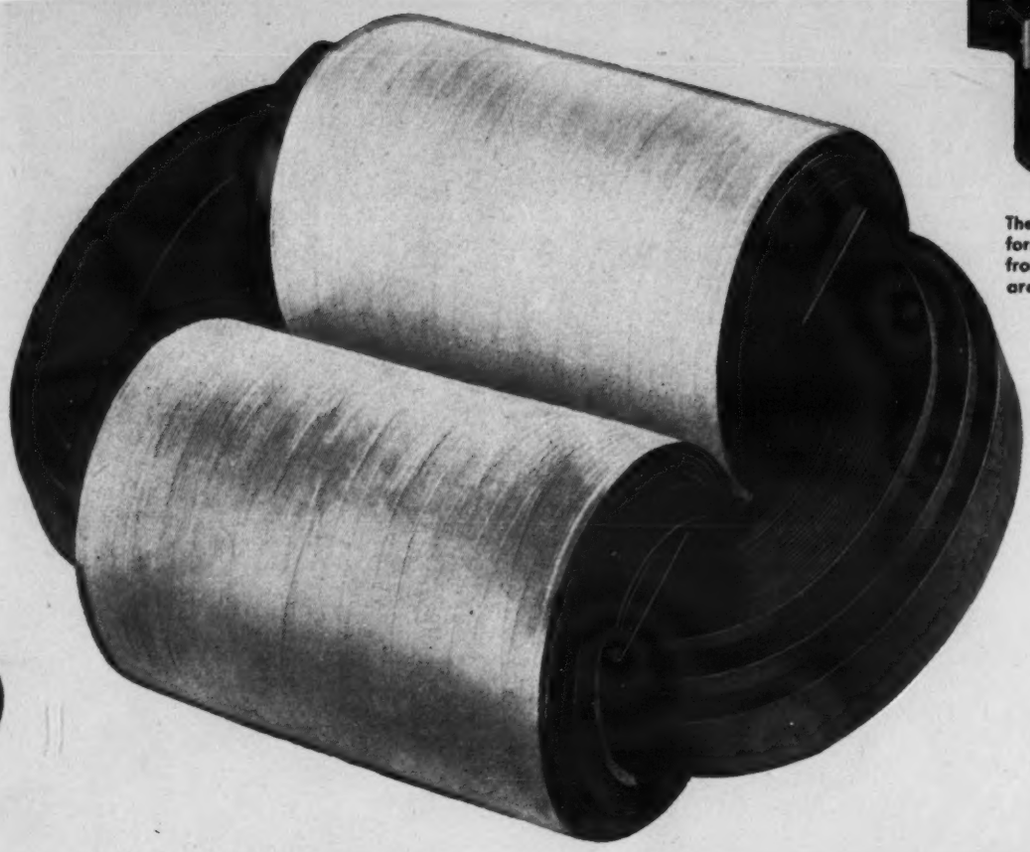

Better Cooling

ore type construction results better cooling because of eater coil surface in contact ith the cooling medium. ong, thin, round coils give bsolute maximum cooling rface. Shape of the wound re permits free circulation cooling medium between e coils and core.

Low Exciting Current

Wound core used in L-M Round-Wound Transformers does not have air gaps and core material is so used that direction of grain of core steel is always in the direction of flow of magnetic flux. These two factors result in a low exciting current which benefits the system power factor.

Good Regulation

Natural proportions of the Round-Wound coil, the number of turns used and the tightness of the round coils result naturally in a low reactance transformer. This low reactance, together with low copper losses and lower total losses, gives excellent regulation at all power factors.

Great Mechanical Strength

Tight winding, without bulging, results from the Round-Wound design. The simple winding process eliminates all sharp bends and turns. This avoids possible damage to the wire and insulation and provides a uniformly greater impulse strength to the L-M Round-Wound coil.

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TRANSFORMERS

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steel towers deliver...the

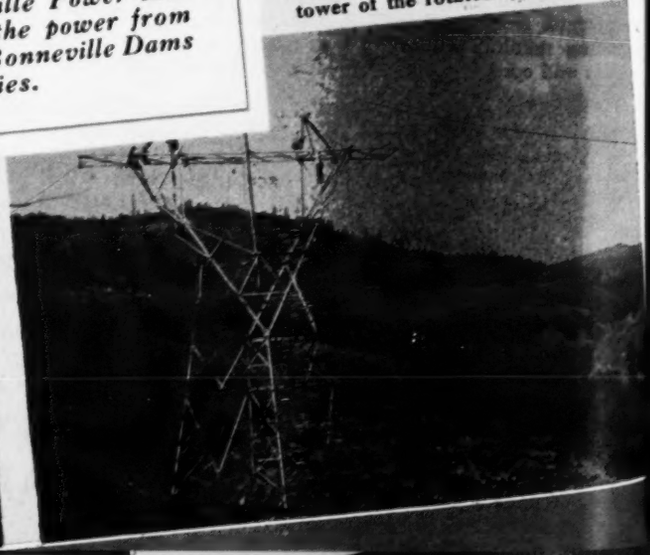
American Bridge Company erection crew placing steel on a 230KV single-circuit, dead-end tower.

Perched on a rocky butte, a double-circuit tower; to the left, two single-circuit towers.

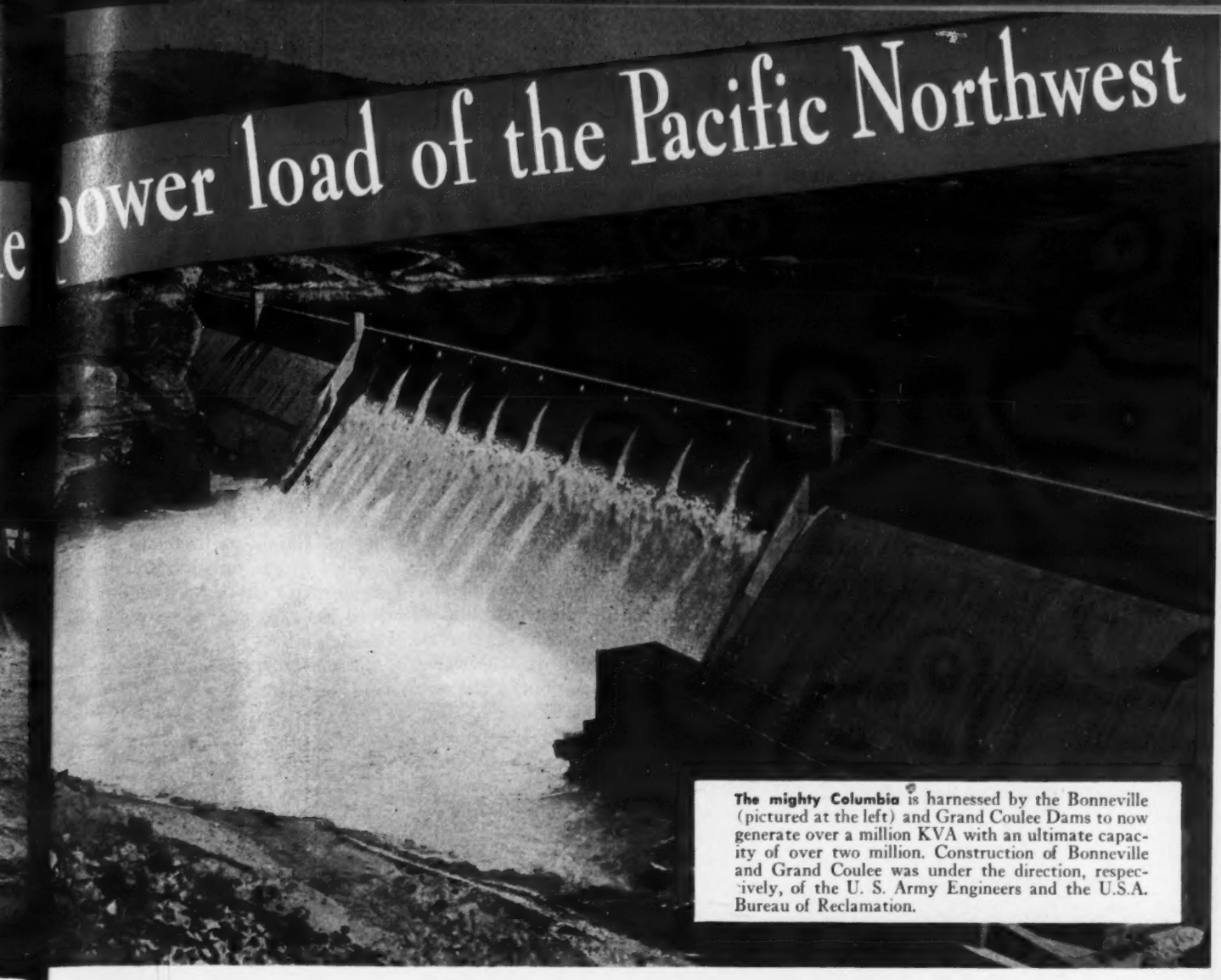
Erecting a 230KV single-circuit tower of the rotated type.

Over 1000 circuit-miles of transmission lines, carried on thousands of American Bridge steel towers—built for the U. S. Department of the Interior, The Bonneville Power Administration—feed the power from Grand Coulee and Bonneville Dams to vital war industries.

Twin transmission-line towers tailored to side-hill descent.



power load of the Pacific Northwest



The mighty Columbia is harnessed by the Bonneville (pictured at the left) and Grand Coulee Dams to now generate over a million KVA with an ultimate capacity of over two million. Construction of Bonneville and Grand Coulee was under the direction, respectively, of the U. S. Army Engineers and the U.S.A. Bureau of Reclamation.

THE Pacific Northwest's major power systems—now interconnected and pooled as a war measure—provide a vast reservoir of electrical energy, each "kilowatt-hour" of which is effectively made to serve the tremendous load-demands of countless industries, homes and irrigation projects now playing a vital part in the giant production needs of a nation at war.

The Grand Coulee and Bonneville Dams, which harness the flow of the mighty Columbia River, constitute the major block of generation for this vast Northwest system. These notable projects with their integrated transmission-lines for power distribution are outstanding examples of America's engineering resourcefulness. Planned and built prior to Pearl Harbor, they now stand the nation in good stead, putting vital electrical power to work on war production.

American Bridge shared extensively in the structural steel requirements of these projects. As subcontractor to Columbia Steel Company, it fabricated and erected the huge, vertical-lift gates for the spillway of Bonneville Dam. For Grand Coulee, it furnished not only the giant, spillway drum gates that rise as they roll, but also penstock gates, power house framework and other miscellaneous steel parts.

And many of the transmission lines radiating from these two sources of power are carried on American Bridge towers of rotated and special types. Scaling the heights and cutting great swaths through forested river bottoms in their traverse of the rugged, virgin country of the Cascade Mountain range, they were engineered for heavy-duty service under extremes of climatic conditions, and tailored to hazardous side-hill and rocky butte formations.

Today, American Bridge Company's resources are engaged in all-out work for our nation at war. Tomorrow, we shall enter the peace prepared with greater facilities and capacity than ever to meet the needs of the postwar program of power development.

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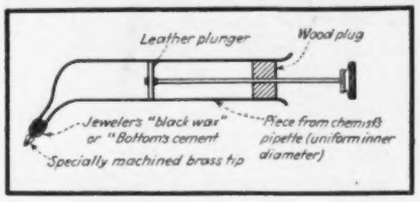
USS

UNITED STATES STEEL

Grease Gun for Meter Shop

Getting lubricant into the small sleeve bearings of dismantled time switch motors is easy with the glass grease gun used at the Central Illinois Public Service Company meter shop, Springfield. To make it, the chemical laboratory donated a short length of pipette (it has a uniform inside diameter) and the glass working skill of the chemist to draw one end out to a small diameter. A minute brass nozzle was sealed to the glass tip, as shown, using jewelers "black wax" (Bottom's cement). A plunger and plug for the top of the tube finished the job. Now a drop or two of light grease can be spotted precisely in the most complicated mechanisms.


Leather plunger
Wood plug
Jewelers "black wax" or "Bottoms cement
Piece from chemist's pipette (uniform inner diameter)
Specially machined brass tip

•

Shop Hints On Coil Insulation

Several of the shop practices currently being used by the Minnesota Power & Light Co., Duluth, in reinsulating the field coils of two 25-cycle salient pole, waterwheel generators of 10,000 kw. capacity contain practical hints on how to handle similar jobs in shops with average facilities.

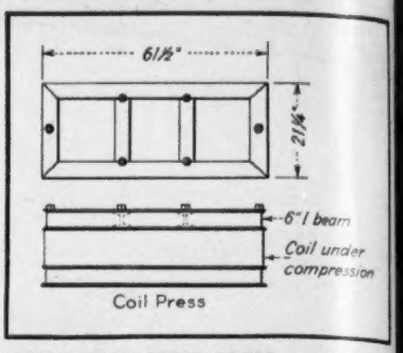
Field coils of these two generators, of which there are eight per machine, weigh 1,200 lb. each. They are made up of 2¼ x ⅛-in. copper strap and when compressed ready for installation in the machine measure 61½ x 21¼ x 8 in.

Preparatory to removing the original varnish and rope paper insulation the coil was opened up by inserting ⅛ x ¾-in. metal spreader straps between turns. Then the coils, suspended from pipe arbors, were immersed individually in a 100 deg. C. solution of water and Okite stripper, mixture was 4-5 oz. of Okite per gallon of water.

Bulk of the old insulation came off in this bath. The balance dropped off in the cold-water rinse that followed. Individual coil turns were then wiped dry and clean by hand.

Before glyptal varnish could be applied to the cleaned coils some method had to be found for stretching the coil turns, spring fashion, to provide working space between turns. The sketch shows how this was done. Four steel bars ⅜ x 1½ in. in section 30 to 40 in. long were suspended vertically from a lifting yoke; two on each side of the coil. The bars on opposite side of the coil, as it lay flat, were in line and had been drilled along their length with a series of equally spaced holes so that ⅛-in. round steel pins—slightly longer than the coil was wide—could be passed through them to support individual coil turns from below. Thus, when fully stretched, each turn of the coil lays upon two ⅛-in. pins supported at their outer ends by the four vertical spacer bars hung from the lifting yoke.

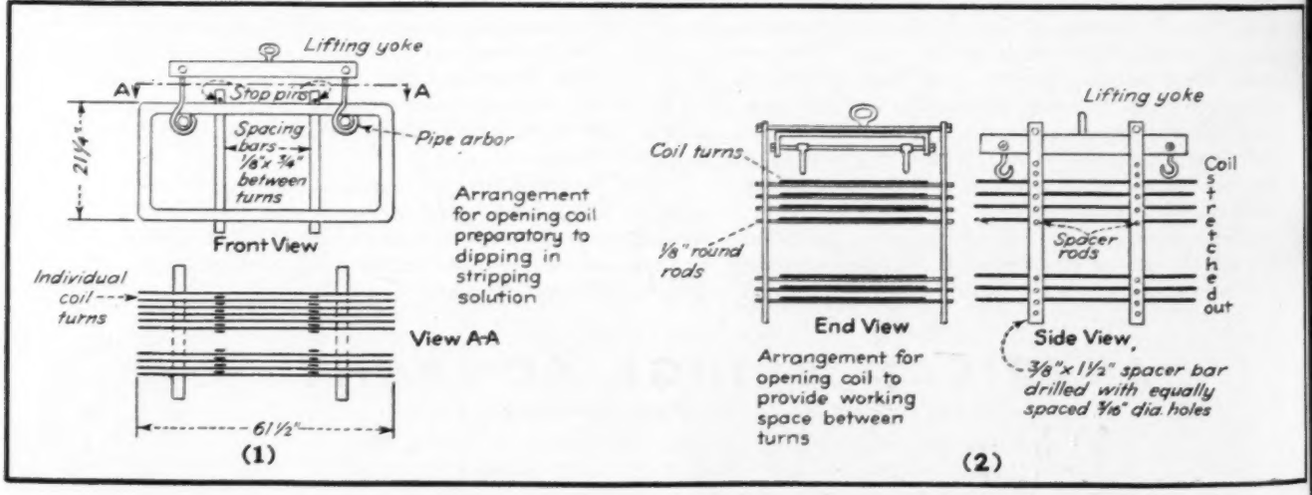
With the glyptal varnish applied, two layers of 0.005-in. varnished craft paper, cut to conform to the shape of the coils, were laid down with joints of the two layers staggered. Insulation was applied to individual turns, starting at the bottom of the coil and working up. Thus when insulaton had been applied to one turn the pins supporting the turn above were removed and that turn dropped down on the new insulation.



STRUCTURAL STEEL PRESS used to compact reinsulated field coil

When all turns were insulated the coil was placed in a home-made press. This consisted of a top and bottom frame of 6-in. I-beams. Pressure was applied by six 1-in. diameter bolts. Bolts were first tightened cold, then the coil and frame were placed in an electrically heated 3-kw. oven and brought up to 100 deg. C. Bolts of the press frame were taken up periodically during the heating period until the coil was compacted to required dimensions and ready for installation on the pole pieces of the generators.

By reinsulating these coils in local shops it was not necessary to ship the coils to the factory. The cost to the company is estimated at 50 percent of the cost of a factory reinsulating job and further crowding of already overloaded factory facilities was avoided.



ARRANGEMENT for opening field coil of 10,000-kva. waterwheel generator preparatory to dipping in hot Okite solution

TO PROVIDE working space during reinsulation coil turns are supported on ⅛-in. diameter steel rods hung from lifting yoke

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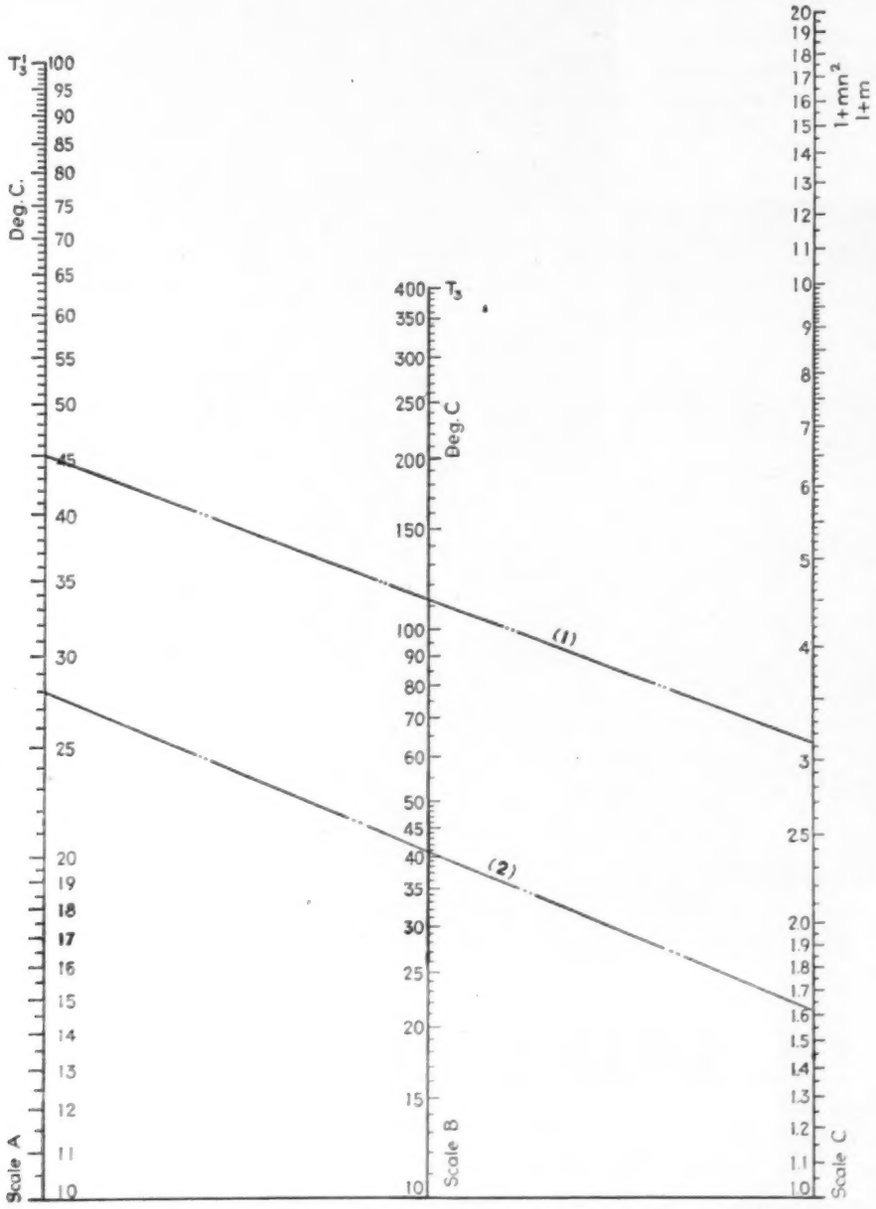
CHART GIVES FINAL CONTINUOUS OIL RISE IN A TRANSFORMER

By H. B. KEATH and W. L. J. F. GODIN†, Wagner Electric Corporation, St. Louis, Mo.

This chart was designed to yield the ultimate transformer oil temperature rise which would be reached after continuous load. It is based on the well established law that the oil rise varies as the 0.8 power of the ratio of the total losses to the normal full-load losses.



† From Bulletin "Normal and Emergency Loading of Power Transformers" written by the authors and presented at 1943 MVEA Engineering Conference. See also issues of *Electrical World*, March 18, 1944, page 116, and April 15, 1944, page 118.

Chart is based on formula:

$$T_3 = T_3^1 \left(\frac{1 + mn^2}{1 + m} \right)^{0.8}$$

where T_3 = Final continuous oil rise and the following are known

T_3^1 = Normal full load oil rise

m = Ratio of losses (copper 75 deg. C./ core)

n = Percent overload/percent normal load

Examples for use of chart

(1) Given: $T_3^1 = 45$ deg. C., $m = 2.5$, $n = 2.0$ (200 percent overload).

Calculate:

$$\frac{1 + mn^2}{1 + m} = \frac{1 + (2.5 \times 4)}{1 + 2.5} = 3.14$$

Connect point 3.14 on scale C to point 45 on scale A.

Read on scale B final oil rise of 112 deg. C.

(2) When n is less than one, use reciprocal value on scale C, that is, $(1+m)/(1+mn^2)$, and interchange scale A and B.

Given: Let normal oil rise = 41 deg. C., and actual oil rise = 28 deg. C. What is the percent load when ratio of losses = 3:1?

Connect point 28 on scale A to point 41 on scale B.

Read 1.62 on scale C.

Then $(1+m)/(1+mn^2) = 1.62$, or $4/(1+3n^2) = 1.62$

Hence, $n = 0.7$ or 70 percent load.

Product improvement through

BRIDGEPORT *New* Phosphor Bronze

Product improvement does not necessarily require radical changes in design or construction. Often it may be accomplished by using a better material for vulnerable parts such as the springs on this prewar switch control for electric ranges.

Springs made from Bridgeport New Phosphor Bronze *completed 6,408,000 cycles during a six months' laboratory endurance test without any sign of failure...* indicating a great reserve of extra resilience, and exceptional resistance to fatigue!

Bridgeport New Phosphor Bronze has improved many well designed products such as electrical switches, radio variable condensers, lock washers, relays, electronic equipment, timing devices, and many others, by replacing materials more subject to fatigue and corrosion.

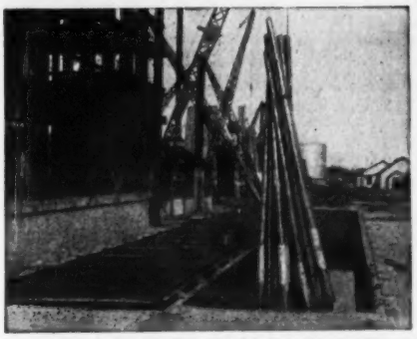
Your program of product improvement or new product development can benefit from the exceptional qualities of Bridgeport New Phosphor Bronze and other Bridgeport alloys.

Mill orders will be accepted in accordance with existing priority regulations

PERMATOX "A"

(A Straight Toxic Wood Preservative)

. . . an answer to the "pole shortage"



Typical full-length dipping vat for the treatment of Poles with PERMATOX "A"

The critical lumber scarcity makes it imperative to treat all new poles . . . as well as to reclaim and re-use old poles by trimming away decayed parts, then dipping, spraying or brushing the clean surfaces with PERMATOX "A" (5% pentachlorphenol in suitable petroleum solvents).

•

This treatment is also effective for cross-arms, ties, racks, crossing planks, bridge timbers and other exposed construction. It insures control of decay and attack of termites or other pests.

PERMATOX "A" is available in *economical concentrates,* (1 to 5 and 1 to 10), for saving freight costs in long shipments.

•

Furnished in Two Forms:—

DOWICIDE 7

Pentachlorphenol* crystals

PERMATOX "A"

5% Pentachlorphenol* in suitable petroleum solvents

*Manufactured by The Dow Chemical Company

Write for Bulletin

A. D. CHAPMAN & COMPANY, INC.

333 N. MICHIGAN AVE., CHICAGO 1, ILL.

Memphis — Portland

New Orleans — New York

Conservation of Material and Space

"VERTICAL FILING" of varying lengths and types of salvaged line wire, tagged for immediate use and stored in adjustable bins, saves space and time on the Boston Edison system in handling an unusually bulky class of material. Front to rear, Hugh Buckley, Austin Horgan and Oliver Stodghill are shown at work in the company's general service buildings

• • •

Test Preservatives in Pole "Garden"

Measurement of the permanence of wood preservatives by using "Mother Nature" supplemented by laboratory methods is described in an article by J. Leutritz, Jr. of the Bell Telephone Laboratories, Inc., and printed in the *Bell Laboratories Record* of December, 1943.

When the preservative shows promise in the laboratory and so continues

Square specimens under exposure in the foreground with stubs and full-size poles in the background planted in the preservative testing "garden"

BAD DIET FOR TERMITES!

Good lumber has always been "good living" for termites—but good lumber treated with Dowicides is something that won't be found on any termite's menu, for the Dowicides put a positive end to termite attack.

Developed after many years of research, the Dowicides—a group of seventeen related products, each with a specific task to perform in the battle between industry and bacteria growths, mold, insects and decay—provide termite control.

Dowicide-treated lumber is clean, easier to handle, non-bleeding, paintable material. Whether used at the time of initial processing, or on the finished end product, there is a Dowicide that will do the job easily and economically. Plywood, fibre and wallboard likewise lend themselves to Dow termite control. Write to The Dowicide Division for additional details.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland
Detroit • Chicago • St. Louis • Houston • San Francisco
Los Angeles • Seattle

DOWICIDE

GERMICIDES AND FUNGICIDES

DOW

CHEMICALS INDISPENSABLE
TO INDUSTRY AND VICTORY

Small . . . but MIGHTY!

. . . the MIDGET "MEGGER"* TESTER is ALWAYS READY FOR USE . . . ANYWHERE

Weighing but 3 pounds, this mighty midget can be carried in a coat pocket or tool kit . . . instantly available for testing insulation resistance of practically all types of electrical equipment . . . indispensable for maintenance and trouble shooting, even where the higher range "Megger" sets could be used. Reads up to 50 megohms and delivers 500 volts D.C. from a built-in hand-cranked generator, making it independent of batteries or external power supply.

If you are not already familiar with this smallest and in many ways the most remarkable instrument bearing the "Megger" trademark, write for Bulletin 1545-W.

**Trade Mark Reg. U.S. Pat. Off.*

Ask also for Bulletin 1735-W describing the new U. S.-made "Megger" Testers.

JAMES G. BIDDLE CO.

1211-13 ARCH STREET • PHILADELPHIA 7, PA.

in field tests on small specimens, larger specimens of fence post size are treated and exposed; and, if this is successful pole-size timbers are treated and placed in the test garden.

In test, clear specimens milled to uniform size are classified as to density. Treatment of wood with preservatives is carried out in an experimental cylinder by either the full or empty cell method. In the full cell treatment the specimens are placed in the cylinder from which the air is evacuated. After a specified time the cylinder is filled with the preservative and pressure is then applied to force the preservative into the cells of the wood. By this method about 30 lb. of preservative may be injected per cubic foot of wood. If less retention is desired the preservative may be diluted with a volatile solvent which evaporates rapidly after treatment. By varying these amounts any desired concentration of preservative may be had.

Empty Cell Method

In the empty cell treatment the specimens are placed in the cylinder and the pressure is raised from atmospheric to from 25 to 50 lb. The preservative is admitted in the cylinder and the pressure is raised still higher, forcing the compound into the wood. Upon releasing this pressure, the expansion of the initial air entrapped by the preservative forces out the excess from the wood and, theoretically, only the cell wall is coated, hence the name, "empty cell" treatment.

After treatment by either of the above methods the specimens are marked with metal identification tags and "planted" in the garden for natural exposure. Once a year they are examined and the amount of decay at and below the ground line is rated. Ten denotes sound condition, and zero complete disintegration.

Valuable information is obtained on the retention of the preservative by the wood after being subjected to ground and air exposure. Laboratory weathering supplements exposure to nature and has been found to yield important additional results.

Data have been obtained on both oil-type and salt-type preservatives. The most promising of the latter appears to be greensalt. This has been used in a limited way in place of creosote where clean full-length treated poles are required.

PREWAR EFFICIENCY FOR LIGHTING SYSTEMS

ALZAK *Aluminum Reflectors*

(REG. T. M.)

Improved lighting, obtained with Alzak Aluminum Reflectors is definitely constructive and important to war industries. Better light means better sight which, of course, means increased efficiency—more materiel for our armed forces. Using aluminum requires no more man-hours of labor; may even save on fabricating and installation time.

Let's review the advantages offered by Alzak Aluminum: Reflecting surfaces meet the requirements of every lighting job, diffuse or specular, and combinations of the two. Reflector shapes can be exactly what are needed for putting light where you want it; aluminum places no limitations on reflector shapes. The glass-like hardness of the Alumilite finish (process patented) makes cleaning easy, assures long life with continued high efficiency.

Alcoa does not make reflectors, only the aluminum sheet from which reflectors are formed. Ask your regular manufacturer of lighting fixtures about Alzak Aluminum Reflectors for essential war uses.

ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh, Pennsylvania

ALCOA ALUMINUM

Electrification calls for KLEINS

BACK from service, experienced linemen and electricians will find jobs waiting for them. Right now, power, communication and transportation companies are making plans to extend essential service to a postwar America.

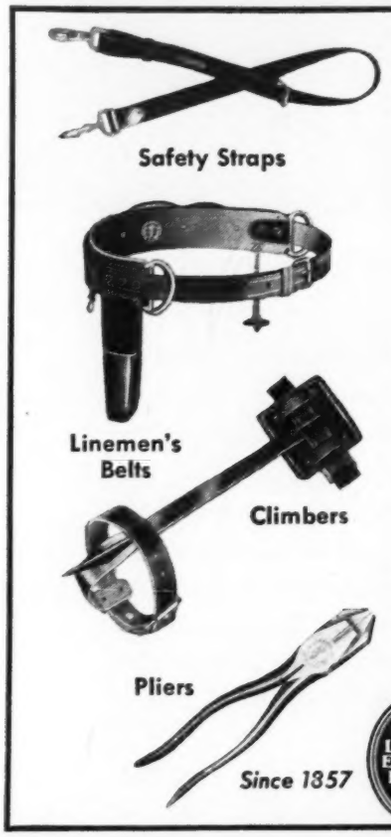
When that time comes, Klein tools and equipment will be back on the job, protecting the man on the pole—helping him to get his work done.

Today, when Klein production is largely needed to meet war demands, linemen and public utility companies are finding that the extra quality—the extra service they receive from the Klein equipment they purchased before the war is serving them in good stead.

The Klein line of tomorrow will have the same extra quality, the same extra service that has been a part of all equipment carrying the name Klein "since 1857."

ASK YOUR SUPPLIER

Foreign Distributor:
International Standard Electric Corp.
New York



This book on the care and safe use of tools will be sent without charge on request.

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

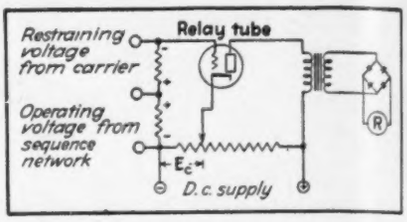
One Carrier Relay for "Phase and Ground"

By S. C. LEYLAND

Relay Engineer, Westinghouse Electric & Manufacturing Company, Newark, N. J.

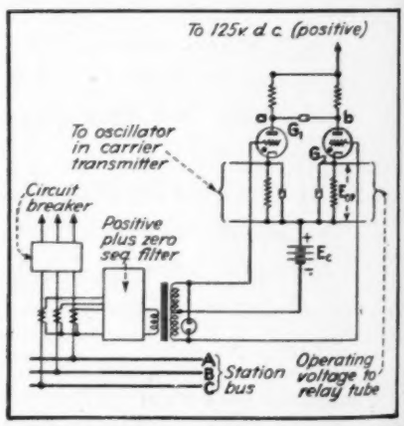
Reduction in number of relays and dependence only on current transformers are significant aspects of a new carrier relay (HKB) devised by Westinghouse relay engineers, particularly appropriate for intermediate transmission voltages.

A single-phase sample of line current unbalance under fault conditions is taken at each end of a protected zone by means of a sequence network.



DIFFERENTIATION between internal and external faults is determined by the phase position of the operating and restraining grid bias

In this way it is possible to omit the potential transformers customarily required for detection of reverse energy flow. It is also possible for a single relay to respond to phase-to-phase, phase-to-ground, or three-phase faults. The relay and its accessories take note only of direction of fault current into or through the section and proceed to block the tripping unless the fault is within the section. In this respect the arrangement is similar in principle to a pilot wire in conjunction with an HCB relay, but is superior in that it overcomes the latter's dependence on impedance (and



SQUARE-WAVE GENERATOR CIRCUIT for obtaining operating and restraining grid bias

This label means a
SERVICE
that protects you
ON FLUORESCENT FIXTURES
Certified
FLEUR-O-LIER
The Manufacturer guarantees by affixing this label that this Fluorescent Luminaire is a duplicate of samples found by periodic examination to comply with the minimum requirements as set up in the
"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"
which are sponsored by the Manufacturers of Mazda Lamps.
Electrical Testing Laboratories, Inc.
NEW YORK, N. Y.
4-42
E·T·L.
A COPY OF THIS CERTIFICATE SHOULD APPEAR UPON EACH UNIT OR PACKAGE
E·T·L.
FLUORESCENT LIGHTING FIXTURES EMPLOYING EXISTING TYPES OF LAMPS ARE NOT RECOMMENDED FOR SCHOOLS, OFFICES AND SIMILAR LOCATIONS UNLESS LAMPS ARE SHIELDED FROM DIRECT VIEW
THIS CERTIFICATION IS CONTINGENT UPON EMPLOYMENT OF CERTIFIED AUXILIARIES OF OVER 85% POWER FACTOR

FLEUR-O-LIER is a *testing* and *certification* service in which over 30 leading fluorescent lighting fixture makers participate. Here's what it means to *you:*

- ★ **Dependable, trouble-free operation.**
- ★ **Fixtures made to 50 definite standards . . . and**
- ★ **Tested by Electrical Testing Laboratories, Inc., of New York.**
- ★ ***Certified* by E. T. L. as meeting the 50 standards.**
- ★ ***Certified* ballasts and starters in every unit.**

Whether you're a user or supplier, the FLEUR-O-LIER Label on a fixture assures dependability, service and protection for you. Insist on it when you specify fluorescent lighting equipment.

FLEUR·O·LIER *Manufacturers*

2126-5 KEITH BUILDING, CLEVELAND 15, OHIO

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

THE Randolph "4"

CARBON DIOXIDE FIRE EXTINGUISHER

ONE HAND ACTION

Portable, lightweight, Randolph "4" is designed for one-hand, self-aimed operation. With no hoses to twist, valves to turn, horns to raise—this extinguisher is PANIC-PROOF. Protection for shops, shipyards, power plants.

RANDOLPH "2"

Ready to combat sudden "flash" fires. This compact, small unit, with exclusive Randolph design, is especially adapted for bracketing in BUSES, TRUCKS, CARS, and MARINE CRAFT.

Foresighted safety engineers demand *streamlined, mobile* fire protection. And *first* in their line of defense is portable carbon dioxide. Randolph "4" . . . the modern extinguisher . . . speeds fire-fighting—kills electric, machine, flammable liquid fires with quick, easy action. Just a touch of the trigger—and powerful carbon dioxide charges into the flames, smothers the blaze in a penetrating, icy blanket.

Randolph carbon dioxide is SAFE. It does not conduct electricity or damage equipment . . . will not deteriorate, and is effective in extreme temperatures. *Approved and labeled by Underwriters' Laboratories, Inc.*

Mobilize against fire with Randolph "4". For prompt delivery *without priority*, 'phone your supply house, or write us—today.

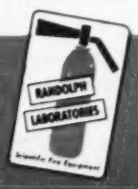
SEND NOW *for new, free booklet "Sharpshooting at Flames." Illustrates latest techniques in carbon dioxide fire-fighting.*

NAME_____

ADDRESS_____

RANDOLPH LABORATORIES *INC.*

8 EAST KINZIE ST., CHICAGO 11, ILLINOIS



therefore length) of the pilot wires.

Only positive half-cycles are employed in actuating the tripping or blocking, and when these are in synchronism (as on a through fault) the tripping is inhibited through the medium of blocking potential applied by carrier transmission on the grid of a 25L6 tube. The arrangement works through out-of-step conditions and a reasonable amount of phase departure resulting from load shifts, length of line or changing current. Carrier is needed for the relaying only at the time of the fault and is therefore available for telemetering, supervisory or communication service at all other times.

•

Needle Valve Bleeds Energized Pothead

By J. L. BARKER
Oklahoma Gas & Electric Co.
Oklahoma City, Okla.

For bleeding air periodically from several 13.8-kv. cables at Huey station, Oklahoma City, after the cables and potheads had been filled with oil, an accessible bleeder valve has been installed on each pothead terminal cap, which permits the pothead to be "bled" at any time without removing the external terminal lug or de-energizing the cable.

Cables on which these valves are used are about 550 ft. long and extend from the plant to the substation yard. They are oil-filled, 900,000-cir.mil, single-conductor, lead-sheath cables and terminate in gasketless type cable potheads, which are equipped with a vent hole in the thin wall pothead terminal cap or "hood" normally closed with a screw soldered to the head.

Normally to bleed the cable and pothead it would be necessary to de-energize the cable and remove the aerial lug to "get at" the vent screw to unsolder it from the terminal hood. Repeated removal of the aerial lug to permit venting in this manner is

NEEDLE VALVE assembly prior to installation on pothead terminal cap

IT WILL PAY YOU TO FILL THIS *VACANT CHAIR*

In much the same way that a metallurgist develops "special analysis" alloys to meet problems of product utility and production, Mosinee paper technicians now apply the science of "paperology" in developing "special analysis" industrial papers.

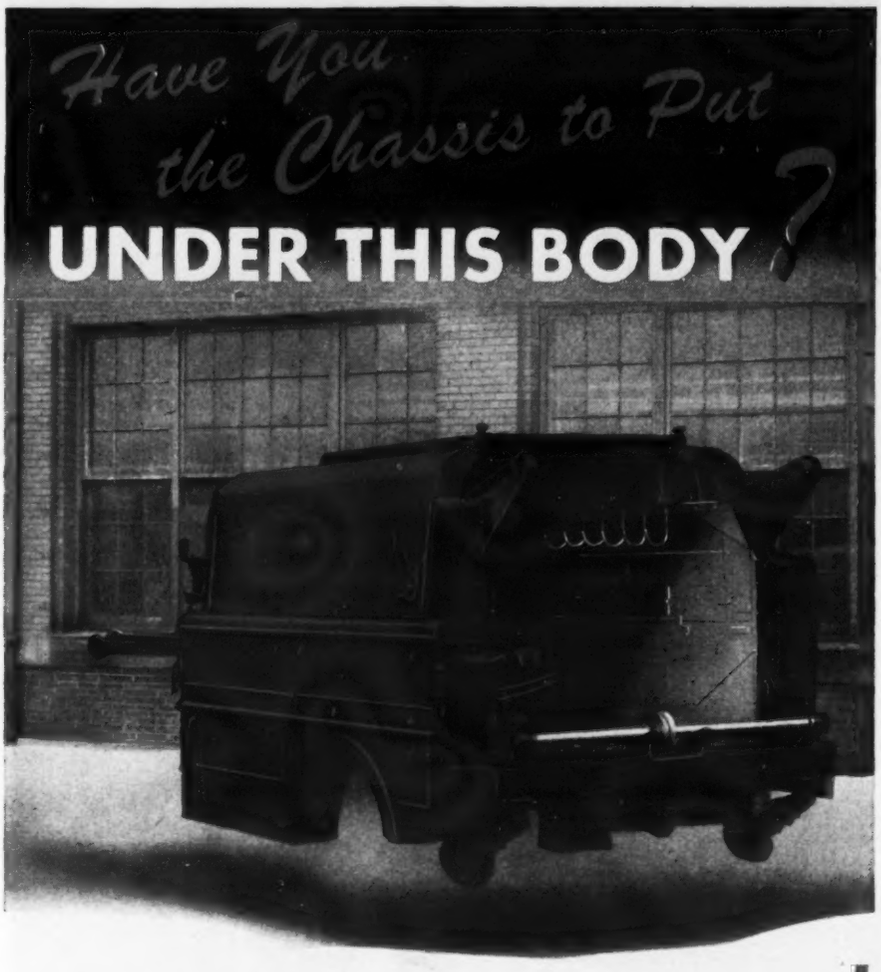
It will pay you to make a place for the paper technician at your conference table, to supplement the analytical engineering that you apply to other component parts of your product . . . because paper today can be developed through specific formulae to replace critical materials and to perform functions for which paper formerly was not considered. The scientific production controls that Mosinee has established, maintain uniformity in the chemical and physical properties or characteristics you require in paper.

The Mills of Mosinee offer unusual experience and facilities in analyzing product and production problems involving paper . . . to help you "make the most of PAPER."

MOSINEE PAPER MILLS CO. MOSINEE WISCONSIN

Please address your letter "Attention Dept. B"

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers



IF YOU HAVE, HERE'S GOOD NEWS!

American Coach can NOW furnish a limited number of Utility Bodies and equipment of the following types: Line Construction Bodies (Model D P L and D T) • Service and Meter Bodies (Model 4460) • General Utility Compartments (Model 4804) • Street Light Patrol Bodies (Model 4671) • Revolving Aerial Ladders (Model 4644) • Telephone Rural Installation and Maintenance Bodies (Model 4551).

With the manpower shortage, increasing costs, and the tremendous pressure on your construction and maintenance crews, you certainly need good equipment— equipment that will really save time and labor, decrease physical strain on your men and increase efficiency. American Coach Utility Bodies and equipment do just this.

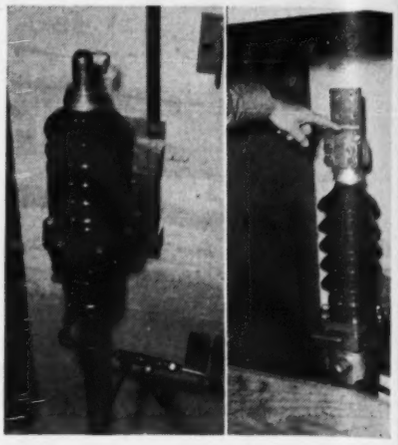
So if you have a new chassis or a good used one write, wire or 'phone for details and complete information.

Some Reasons Why "Americans" Are TOPS:—
Correct Design • Superior Quality Construction • Comfort • Convenience • Safety • Endurance • Low Operating Cost • Fine Appearance

THE American COACH & BODY CO.
PUBLIC UTILITIES EQUIPMENT FOR MOTOR VEHICLES

undesirable as well as inconvenient, since it would undoubtedly damage the pothead terminal hood. In this type pothead the thin walled hood is compressed against a solid internal conductor ferrule by the clamping action of the aerial lug, to provide a solid electrical connection.

To facilitate the venting operation and permit this to be done while the



POTHEAD with aerial lug removed to show needle valve soldered in place over vent plug in pothead terminal cap; author points to needle valve body mounted on side of aerial lug; by loosening needle valve with hot stick air can be bled from pothead while it is energized

cable is energized, and without removing the aerial lug, the vent plug screw in the top of the hood was removed and an inverted brass cup, about 1 in. in diameter and $\frac{1}{4}$ in. deep, was soldered to the top of the terminal hood over the vent hole. From this cup a short $\frac{3}{16}$-in. copper tube with a 90-deg. bend was led to a needle valve body mounted against the aerial lug. The needle valve body was made from $\frac{3}{8}$-in. hexagonal brass stock. The needle valve itself was made from a No. 10/32 screw 1 in. long, with the screw head replaced with a knurled nut. A $\frac{3}{32}$-in. porthole was drilled in the needle valve body to provide the outlet for air and oil bled from the pothead.

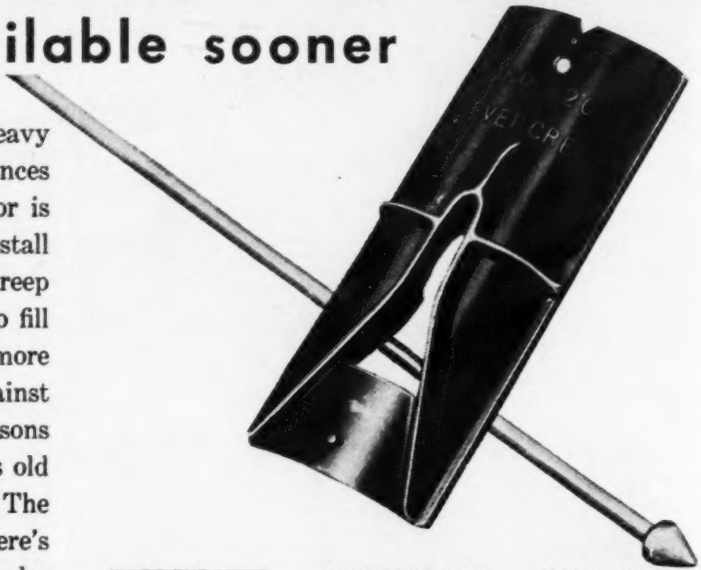
Installed as shown on the pothead, any air in the cable or pothead passes up into the top of the terminal hood through air vent grooves in the inclosed conductor terminal ferrule. By opening the needle valve—using a hot stick when the cable is energized—the air passes from the pothead terminal head into the cup and tube and is exhausted to atmosphere through the porthole in the needle valve body.

They cross faster . . .

Signal Corps photo

. . . One reason NEVER-CREEP ANCHORS have not been available sooner

Aerial ferries for crossing streams with heavy armored equipment go up faster in many instances because the old familiar Never-Creep Anchor is on the job. It requires only a few minutes to install a few substantial guys by using the Never-Creep because it is not necessary to take the time to fill up the hole and tamp it in. The guy is more dependable, too, because it pulls entirely against solid earth. So there you have one of the reasons for the difficulty in getting shipments of this old utility standby, the Never-Creep Anchor. The Army requirements come first. Then, too, there's a shortage on malleable castings and each order must wait its turn. Still there are Never-Creeps being shipped and many utility men would say they're worth waiting for. They can at least be included in your Post War Plans.



For complete information on Never-Creep Anchors, Steel Expanding Anchors, Screw, Cone, and Rock Anchors, consult your Chance Catalog, ask your jobber, or write direct to

A·B·CHANCE CO·
CENTRALIA, MISSOURI.

ABC INDUSTRIES

LOAD SERVICING

Industrial • Commercial • Rural • Residential

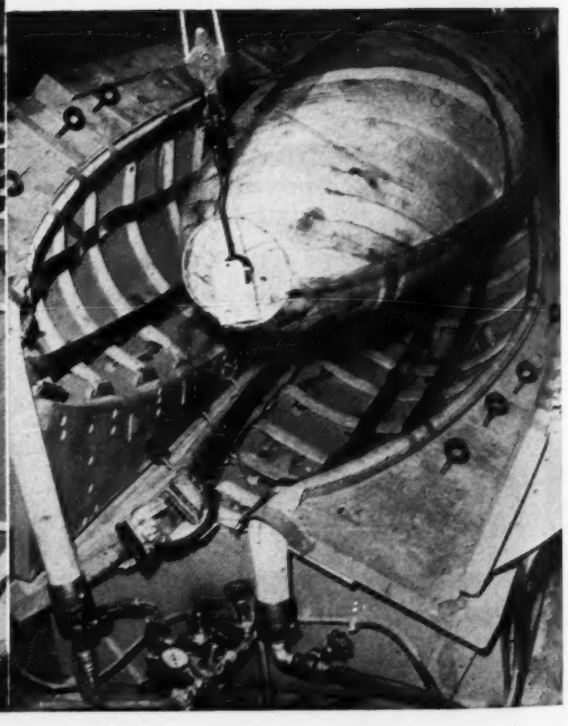
Electric Heat for Plywood Fabrication

By F. C. LEACH
Dept. of Water Power
Los Angeles, Calif.

Plywood, rapid thermosetting polymerizing synthetic glues and an interesting application of electric heat are being used by the Gillespie Furniture Co. of Los Angeles in the fabrication of expendable gasoline tanks for aircraft auxiliary fuel supply. The compound curves of the cigar-shaped tanks created an unusual problem in the application of electric heat. The basic method used in the final assembly of the tanks is the use of thin stainless steel sheet as a direct contact electric heating element.

The tanks are 15 ft. long and 3 ft. in diameter at the largest section. The skeleton structure consists of bulkheads fabricated of sheet plywood, reinforced with built-up plywood around the circumference and interior stiffener strips. The bulkheads are assembled on sheet metal positioning jigs, glue applied to contact surfaces and "cooked" in the three-deck, air-operated, platten press shown. The three bulkheads are set simultaneously in 2½ min. The press has four surfaces, each encasing nine 800-watt Chromalox strip heaters.

All glued joints in the skeleton structure are thermoset by means of C-clamps equipped with forty-five 75-watt General Electric cartridge heaters encased in steel blocks. Preformed plywood skins in three sections having scarved edges, are laid over the skeleton. The tank is then moved to the "cooking" jig, which consists of an oak framework equipped with pneumatic tubes which



THREE-DECK electrically heated platten press for fabricating plywood bulkheads (left). Cartridge heaters encased in steel blocks and held in place by C-clamps apply heat for thermosetting glues in assembling the skeleton (lower left). Heating elements consisting of stainless steel strips are used in the "cooking" jig for bonding the scarved joints of the shell in the final assembly of cigar-shaped plywood expendable gasoline tanks. This novel application of electric heat has made possible production of a tank every 15 minutes (below)

KELVINATOR SERVICE PROGRAM TO HELP BUILD CUSTOMER GOOD WILL!

TYING IN WITH "BETTER CARE—LESS REPAIR" PROGRAM, NATIONAL ADVERTISING SPEARHEADS PLAN FOR HOLDING AND BUILDING CUSTOMER GOOD WILL DURING CRITICAL SERVICE PERIOD AHEAD

The third war summer presents the greatest maintenance and repair problems ever faced by the appliance industry. To help boost the "Better Care—Less Repair" program, Kelvinator has built its 1944 Wartime Service program. Fully described in its plan book—"Keeping Friends Through Wartime Service"—it suggests how and where dealers can obtain new men; how to train them; how to handle customers to obtain friendly cooperation; and shows material from national magazine ads to dealer letters to help the dealer over the service hump this summer. Comprehensive and complete, the Kelvinator Wartime Service Program is offered at a time when it is most seriously needed!

BETTER CARE—LESS REPAIR is the theme of the two Users' Guides on both refrigerators and electric ranges. Each Guide tells housewives how to keep these appliances operating efficiently—gives a check list of the ten most important things to do before needlessly calling a service man.

NEW MAGAZINE ADS dramatize the utility and refrigerator dealers' determination to keep owners "in refrigeration" and "cooking facilities" for the duration. Breaking in June and July—just when the service rush will be heaviest—their big job is to gain the understanding and cooperation of customers if their service calls cannot be handled promptly. These striking color ads will appear in the *Saturday Evening Post, McCall's, Better Homes & Gardens, Good Housekeeping, Household, True Story* and *American Home!*

BETTER CARE — LESS REPAIR

LOCAL NEWSPAPER ADS that obtain the friendly cooperation of customers are available to all Kelvinator dealers, in half a dozen economical sizes. These personalized "Better Care—Less Repair" ads take customers into the dealers' confidence, ask their help by playing up the free "Users' Guides."

Awarded Propeller Division, Nash-Kelvinator Corporation.

LOOK AHEAD WITH KELVINATOR

DIVISION OF NASH-KELVINATOR CORPORATION

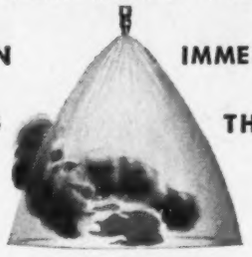
Kenosha · Milwaukee · DETROIT · Grand Rapids · Lansing

ETERNAL VIGILANCE
is the PRICE OF PROTECTION from OIL FIRES

WHEREVER AN "AUTOMATIC" FIRE-FOG INSTALLATION HAS BEEN MADE, THIS IS WHAT IT DOES:

❶ STANDS GUARD DUTY AT THOSE PLACES WHERE FIRE HAZARDS EXIST DUE TO OIL OR OTHER FLAMMABLE LIQUIDS; ❷ SOUNDS

THE ALARM WHEN FIRE BREAKS OUT; ❸ GOES INTO ACTION IMMEDIATELY AND AUTOMATICALLY, QUENCHING THE FIRE QUICKLY AND COMPLETELY



There is no mystery about an "Automatic" FIRE-FOG System and the effective manner in which it quenches fires. FIRE-FOG's nozzle structure reduces water to a mist-like spray. This *cloaks* the flames, *cools* and *chokes* the fire, *extinguishes* the blaze . . . just the protection needed for oil quenching tanks, electric transformers, enamel dip tanks, open tanks of flammable liquids, etc.

AND NOTE THIS: At "Automatic's" Proving Ground we reproduce the fire hazard *you* face, then proceed to demonstrate the "Automatic" System that provides *exactly the protection needed.* An "Automatic" Engineer will be glad to give you the details.

"AUTOMATIC" FIRE-FOG

★ IT BLANKETS
★ IT ISOLATES
★ IT QUENCHES

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA ★ YOUNGSTOWN, OHIO

• • • OFFICES IN PRINCIPAL CITIES • • •

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA — RATE OF RISE — TRADE MARK REG. U.S. PAT. OFF.

apply uniform pressure over the surface of the tank and especially along the lateral scarved joints and bulkheads.

Between the pneumatic tubes and the plywood surfaces are nine strips of stainless steel, 0.015 thick and 2½ in. wide, running the entire length of the jig. Three strips overlie the scarved joints and the other six are distributed uniformly around the tank. The strips are connected in series across a 120-volt circuit and consume approximately 10 kw.

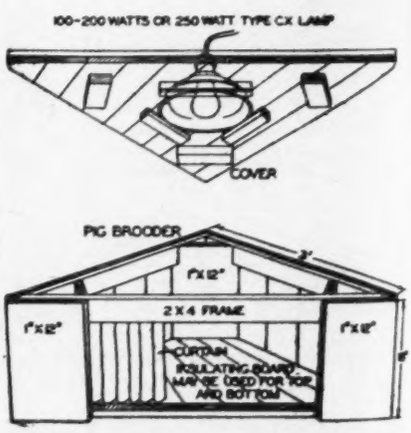
Temperature control is by means of an interval timer operating through a magnetic contactor. The interval timer was found superior to thermostatic control for this application because of the temperature limitations imposed by thermosetting glues. The time lag of the thermostat was found to permit excessive temperatures to occur at some points due to variations in the amount of exposed radiation surfaces.

Tail and nose plugs are glued in, surfaces are power sanded and the tanks are then filled with a flushing compound for sealing them leaktight. Cloth strips cemented to the surface cover all joints and provide a smooth contour. The entire manufacturing process is a fine example of American ingenuity and the special tools, jigs and applications of electric heat might well be adapted to other plywood fabricating problems.

•

Shop Design for Electric Pig Brooder

This design for an electrically heated pig brooder was developed by the rural service department of Northern States Power Co. as a shop project



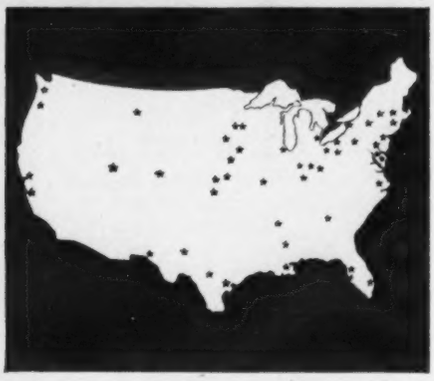
PIG BROODER heated by lamp

FRIGIDAIRE Thilmotized SERVICE — BETTER CARE LESS REPAIR

Frigidaire's Wartime Service Program Helps Dealers

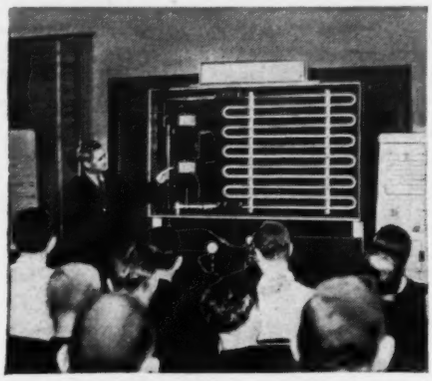
EXTENSIVE FACTORY FACILITIES are devoted to the manufacture and distribution of parts and assemblies, so that Frigidaire dealers may keep the millions of Frigidaire refrigerators and other installations in essential wartime operation.

PARTS—thousands of different kinds are stocked here, ready to be sent to dealers for use in Frigidaire models of the past 25 years. On hand for making these service parts are thousands of tools and dies used for the original Frigidaire parts.



45 DISTRICT SERVICE ORGANIZATIONS blanket the country, giving Frigidaire dealers everywhere quick access to the most commonly needed replacement parts, extensive repair facilities, supervisors who assist them on technical matters.

TRAINED TECHNICAL MEN are available to individual Frigidaire dealers to help them work out any special service problems that may arise...help the entire Frigidaire Dealer Organization in carrying out effective serviceman-training programs.



FIELD TRAINING SCHOOLS by factory and district instructors give hundreds of new and experienced servicemen basic and advanced training in Household and Commercial Refrigeration, Electric Range work. Night school classes are popular.

SERVICEMAN-TRAINING AIDS include Primary and Advanced Training Courses, streamlined field schools, 9 valuable training films, a timely manual and film on customer relations, Handy Reference Guides, 2 comprehensive Service Manuals.

5 IMPORTANT OBJECTIVES

Started more than two years ago, Frigidaire's Wartime Service Program is a *continuous* major activity to help dealers accomplish these important objectives:

1. To cooperate with the Government's Food Conservation and Health Protection programs.
2. To help keep the nation's refrigerators running.
3. To locate and train necessary service manpower.
4. To obtain essential service parts.
5. To build good will and maintain income.

For Excellence in War Production — ARMY E NAVY

FRIGIDAIRE
Division of
GENERAL MOTORS

Peacetime builders of
ELECTRIC REFRIGERATORS · RANGES · WATER HEATERS
HOME FREEZERS · ICE CREAM CABINETS
COMMERCIAL REFRIGERATION · AIR CONDITIONERS
BEVERAGE, MILK, AND WATER COOLERS

BUY MORE WAR BONDS FOR VICTORY!

★

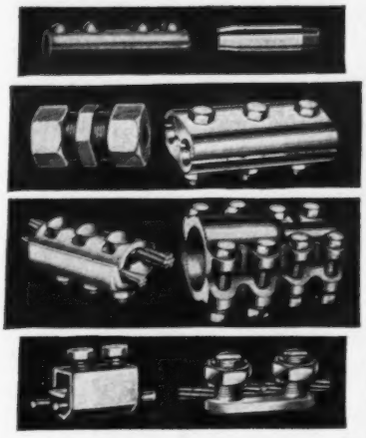
Listen to
GENERAL MOTORS SYMPHONY OF THE AIR ...
Every Sunday Afternoon, NBC Network

★

"It sure is HANDY— to have ALL kinds in One Catalog!"

For any good Straight or Parallel *Connector, see the* **COMPLETE** *line*

These illustrations can only suggest the wide variety in the Penn-Union Catalog . . . a *complete* line of Bolted Straight Connectors and Reducers . . . Screw type . . . Split Sleeve type . . . Shrink fit . . . Universal Parallel Clamps . . . E-Z Connectors that take a wide range of conductor sizes.



Also . . . the most complete line of Service Connectors, Tee Connectors, Cable Taps . . . Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Terminal Lugs.

Penn-Union connectors are the first choice of leading utilities, industrials, electrical manufacturers and contractors—because they have found that *"Penn-Union" on a fitting is their best guarantee of Dependability.*

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

for vocational agriculture schools and manual training classes of rural schools. It can be built from materials available in most farm work shops. Either a 100- or a 200-watt incandescent lamp or a 250-watt CX lamp may be used at the heat source. The materials required are as follows:

Material	Dimensions	Use
Two by four	1-14'x3⅝"x1⅝"	Frame at top
Shiplap	20 bd.-ft.-6/	Top, floor & sides
Board	1-6'x12"x1"	Front & corners
Boards	2-10'x4"x1"	Floor & cover framing
Fiberboard (if used)	16 sq. ft.-½"	Floor & cover insulation
Nails	2 lb.-6 & 8 d.	As needed
Appliance Cord	1-12 to 20'-No. 12	Service to brooder
Two Prong Plug	1-heavy duty	Service conection
Reflector	1-12 to 16"	Heating unit
Lamp Bulb	1-200 to 300W.	Heater
Curtain (if used)	1-14"x30"	Doorway

• • •

"Electricity Is Cheaper Than Ever"

During this war-time period while the cost of living has increased, one item, the cost of electricity, has been decreasing and is cheaper than heretofore. The Georgia Power Company apprises its customers, particularly residential users, of that fact by advertisements and at the same time infers the further use of electric energy for domestic purposes.

The advertisement (see illustration) carried a schedule for fourteen newspapers in the territory served by the utility company. Walter and Inchcliffe in a characteristic grocery store scene aid in conveying the company's message that the average price per kilowatt-hour in Georgia homes was 2.74 cents in 1940, but only 2.61 cents in 1943—a decrease coming at a time when practically everything else is increasing.

WALTER AND INCHCLIFFE

You've got something there, Inchcliffe! Electric service is getting cheaper all the time, while other things are going up. For instance, the average price per kilowatt hour in Georgia homes was 2.74 cents in 1940, but only 2.61 cents in 1943 — a *decrease* coming at a time when practically everything else is *increasing.*

(Advertisement of the Georgia Power Company)

ADVERTISEMENT carries message for cheap electric service and suggests its further use

Veteran in Search of a Peacetime Future

THIS veteran knows of no job to come back to after the war.

It was born of war necessity—built to perform a strategic purpose new in the history of aircraft.

The requirements were an engineering challenge. It had to be strong to do its heavy work. Yet it had to be light and fit in the small space available.

That is why even optimists doubted such a device could be built.

But here it is: The Lear Actuator.

Its job is operating flaps, landing gears, shutters and other equipment on the power of an airplane storage battery.

Now, of course, our plants are working round the clock to make enough of these for the fighting ships of Uncle Sam.

But we know that such unique devices, the midget motors that drive them and all the 250 Lear products, must have an important future in some peacetime products.

They may park your car with the push of a button—or do any of thousands of jobs we haven't thought of.

That is why we are telling you about them. We want to find jobs for these able veterans.

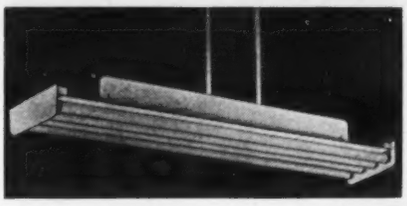
And we want you to know that the kind of engineering thinking and production technique that made them possible is available.

PLANTS: Piqua, O., and Grand Rapids, Mich. BRANCHES AT: New York, Los Angeles, Chicago, Detroit, Cleveland, Providence.

NEW EQUIPMENT

Luminaires

Lighting units are available in both pendant and ceiling-mounted types and can be used both individually and in continuous rows in offices and drafting rooms. They have steel wiring channel and flat "Fluratex" non-metallic reflector, ballast shields and reflector ends. These unshielded units



"Ranger" luminaires: accommodates four 40-watt fluorescent lamps; wired for 110-125 volts, 60 cycles, also 220-250 volts; high power factor tulamp ballasts; width 9½ in., length 48 in. **Curtis Lighting, Inc.**, 6135 West 65th St., Chicago 38, Ill.

can be converted into the company's "Warrior" luminaires by obtaining the louver body and louver end plates.

•

Phosphate Comparator

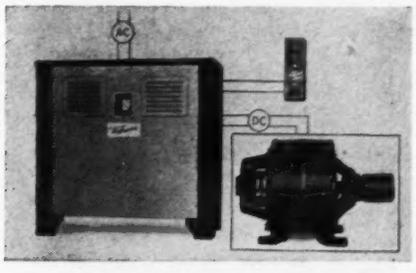
Block Phosphate Comparator. **La Motte Chemical Products Co.**, Towson 4, Baltimore, Md.

Unit for phosphate treatment of boiler feed water to prevent scaling employs two reagents, one of which is in solution form. Range of concentration covers 0 to 100 p.p.m. PO_4. Higher readings are obtained by the dilution principle.

•

Electronic Drives

Self-contained "package" units employ electronic rectified tubes to convert alternating current to direct current for d.c.



Electronic adjustable speed motor drives: capacities ½ to 3 hp., single-phase, and 5 to 10 hp., three-phase, 220/440 volts at 60 cycles, 550-volt and 25 or 50 cycles. **Weltronic Company**, 20735 Grand River, Detroit 19, Mich.

motor armature and shunt field circuits. Each circuit is individually controlled through other electronic tubes to provide speed adjustment and current regulation. Start, stop, reverse and speed selection control stations supplied.

•

Building Wire

Type "SNW" Flamenol building wire: sizes No. 14 to 4/0 inclusive; temperature rating 50 deg. C. **General Electric Co.**, Bridgeport, Conn.

Developed for use in raceway systems in wet locations (Section 3035 of NEC) the new type wire has a thermoplastic insulation with low moisture absorption. It is said to be flame resistant and will not support combustion, is resistant to oils, acids and alkalies. It has a small diameter, permitting more conductors to be used in one conduit or duct or permitting smaller conduits or ducts to be used.

•

Control

Model "1601" electronic control: 110-120 volts, 60 cycles; height 14 in., width 12 in., depth 10 in. **Mechemal Engineering and Sales Co.**, 4313 Lincoln Ave., Chicago, Ill.

Unit has been designed for use in an electrolytic process to disintegrate and dissolve embedded fragment of tap or drill in castings and machined parts. Special formula solution is used for every nonferrous metal and alloy. Blocking agents in the solution are said to prevent electrolytic attack upon the nonferrous metals so that there is no change in hole or thread dimensions. Solutions are also available for use with the control for anodizing, chromatizing, phosphatizing, cleaning and plating of metals.

•

Wire Terminals

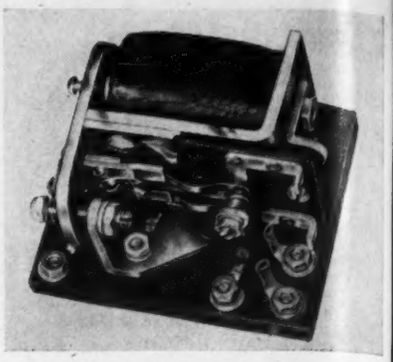
"Diamond Grip" pre-insulated solderless terminals: ring tongue; available for No. 22 to No. 14 wires; each terminal accommodates several wire sizes. **Aircraft-Marine Products, Inc.**, 1523 North Fourth St., Harrisburg, Pa.

Each terminal has bonded insulation. Press dies or a hand tool resembling a pair of pliers are used to crimp the terminal and the wire. This method is said to seal the wire against accelerated corrosion.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Relay

For general use, relay is designed so that its armature practically completes its travel before the contacts snap with a positive



Type "79-XAX" sensitive snap-action relay: normal sensitivity 0.01 watt; contacts S.P.D.T., rating 10 amp., 110 volts a.c. and 24 volts d.c.; withstands 10 G vibration and shock; coil resistance available from 0.25 to approximately 30,000 ohms.; weight 10 oz. **Struthers-Dunn, Inc.**, 1321 Arch St., Philadephia, Pa.

action to the corresponding position. Contacts remain closed with full pressure up to the instant of transfer to the other position.

•

Motor Starters

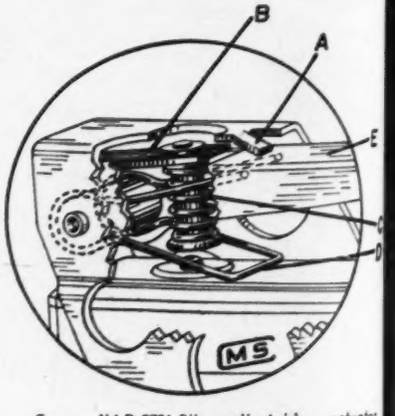
Type "ZHS" full-voltage oil-immersed starters: for 2,300, 4,150 and 4,600-volt motors; three ratings, moderate interrupting capacity (10 times full load motor current), 25,000 and 50,000 kva. interrupting capacities. **Electric Controller & Mfg. Co.**, 2700 East 79th St., Cleveland 4, Ohio.

Starters are available in type III (weather-resistant) enclosure, in combination form (with self-contained disconnect switches), and in type VIII enclosure for use in Class I Group D hazardous locations. They are provided with overload relays and potential transformer for 220-volt control. Push button control circuit is protected by enclosed fuse.

•

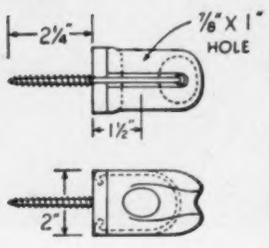
Switch Bracket

Adjustable bracket permits "on the job" adjustment and also affords mechanical protection to the Bakelite housed Micro switch. It provides tabs A and B on the steel actuator bracket and the lever arm E

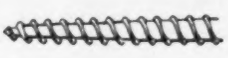


Type "AD-5721-R" adjustable actuator bracket for Micro switches. **Micro Switch Corporation**, Freeport, Ill.

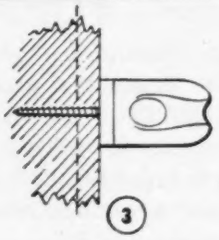
HUBBARD 4-11-44 WIREHOLDERS



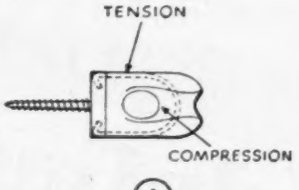
1 Two Views of Hubbard 4-11-44 at 90° Turn



2 Special Screw



3 Full Thread



4 Cut-away Section

1. Two diagrams of the Hubbard 4-11-44 Wireholder showing its sturdy construction. Tests on these wireholders, dead-end pull, have far surpassed recommended ratings on standard house service conductors. This is true of the wireholder itself. To insure maximum strength of an installation, a solid mounting is necessary. Attachment to sheeting so thin as to engage only a small portion of the screw (as shown by dotted line in Fig. 3) naturally reduces the holding power of the installation as a whole, no matter what the strength of the wireholder may be. This should be avoided.

2. Not an ordinary wood screw, but specially designed with a sharp point and a small root diameter near the point to allow easy starting. A light pressure is sufficient to start the screw in wood.

3. Full threaded screw, so that unavoidable installations on thin material are not caused to be excessively weak by lack of threads near the base. (See dotted line showing how installation on thin wood will not develop full strength of wireholder owing to reduced holding area of screw threads.)

4. A "tried and true" Hubbard Wireholder principle of thirty years success. Metal parts in tension — Porcelain parts in compression under load.

HUBBARD AND COMPANY

Pittsburgh
Chicago

Oakland
California

THAT GIVES FIRE A FAST *KO!*

If there ever was a time when America could not afford to risk destructive fires around power production equipment, that time is NOW.

That's why you see PLUS-FIFTY DUGAS Dry Chemical on duty in so many vital spots today.

PLUS-FIFTY DUGAS DRY CHEMICAL STOPS FIRES FASTER!

Immediately on hitting fire (whether electrical or flammable gases or liquids) PLUS-FIFTY DUGAS Dry Chemical releases fire-killing gases —smothers fire speedily. Safe to use because of its long-range effectiveness and because it is non-toxic.

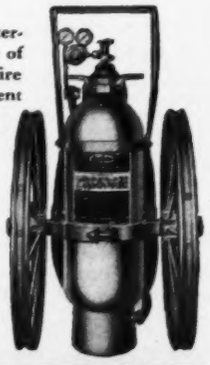
PLUS-FIFTY DUGAS Dry Chemical is harmless to everything except fire!

For priority facts regarding PLUS-FIFTY DUGAS Dry Chemical and DUGAS Fire Extinguishing Equipment, write us today.

Approved by Underwriters' Laboratories and Factory Mutual Laboratories.

PLUS-FIFTY
duGas
REG. U. S. PAT. OFF.
DRY CHEMICAL
U.S. PATENT 1788603

CHART showing characteristics of all types of approved hand fire extinguishers sent free on request.



MODEL 150 WHEELED EXTINGUISHER

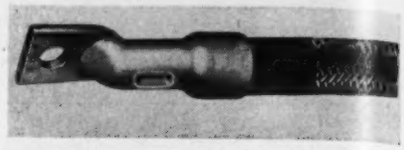
DUGAS ENGINEERING CORPORATION, MARINETTE, WISCONSIN
OWNED AND OPERATED BY ANSUL CHEMICAL COMPANY

which in combination with the functioning of the overtravel spring mechanism C and pretravel spring D permits changing the mechanical characteristics of the unit.

•

Terminal Lug

Barrel of the lug is indented onto the conductor and the shroud is compressed by Hypress method over the insulation, said



Type "YA-LH" Hysealug terminal: sizes for conductors No. 18 to 2½ million cir. mils. **Burndy Engineering Co.**, 107 Eastern Blvd., New York 54, N. Y.

to make a water-tight cable-end seal. Hysealugs may be supplied without plating or plated to specification, also with blank tongues or drilled holes as required.

•

Wrench

Multi-socket wrench: accommodates No. 10 and No. 12 standard, ¼-in. standard and light, and 5/16-in. hexagon nuts; provides a clearance through barrel for studs up to 5½ in. long. **Eastern Specialty Co.**, 3617 North 8th St., Philadelphia, Pa.

By pressing wrench over any of the three sizes of nuts automatically selects the proper nested hexagonal tube suited to the particular nuts. Handle is a die cast aluminum member pressure-moulded to the hexagon steel barrel. Molded insulation is said to be capable of withstanding a dielectric test for one minute at 5,000 volts rms. Wrench is suitable for servicing or production work.

•

Fence Controller

Controller with an inclosed battery is designed for outdoor service and is used on barbed wire fences to segregate livestock and keep predatory animals out of gardens. At approximately one-second intervals an oscillating rotor pendulum delivers a

Electrical fence controller: operates from either hot-shot or storage batteries or a.c. power supply. **Northern Signal Co., Inc.**, 120 North Broadway, Milwaukee, Wis.

charge for one-tenth of a second to the fence wire. Unit has protective shatterproof transparent Tenite housing, forming a watertight assembly, permits observation of motor and neon signal light. Three wiring terminals, of which a lightning arrester is part, are provided on the housing.

•

Static Bar

Line of metal encased static bars with an outer casing of fiber has been developed to eliminate positive charges of electricity

Fiber covered midget static bars. Simco Company, 4929 York Road, Philadelphia, Pa.

which are inherent in such materials as wool, nylon, rayon and certain kinds of transparent films. Charged inner bar has a brass casing over which is a snugly fitting fiber casing. Brass casing is charged by induction from the inner bar and ground and its potential is adjustable. The bars are stated to be suitable where inflammable vapors are present.

•

Lock Nut

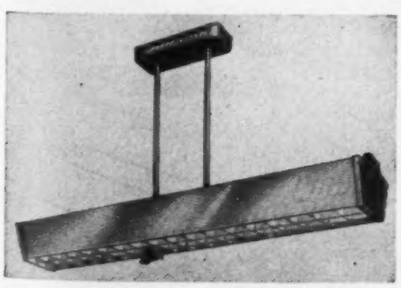
Self-locking nut: made in 14 bolt sizes from ¼ to 1½ in., with National Coarse or National Fine thread. Stover Lock Nut and Machinery Corp., Easton, Pa.

One-piece nut is stated to clutch the bolt firmly and not shake off. Upper part of the threaded portion is made slightly elliptical while the lower threaded portion remains circular. Nut can be screwed on a normal bolt by hand about half way, then requires use of a wrench. It locks itself by utilizing the natural elasticity of the metal, can be made to any torque required and of any material.

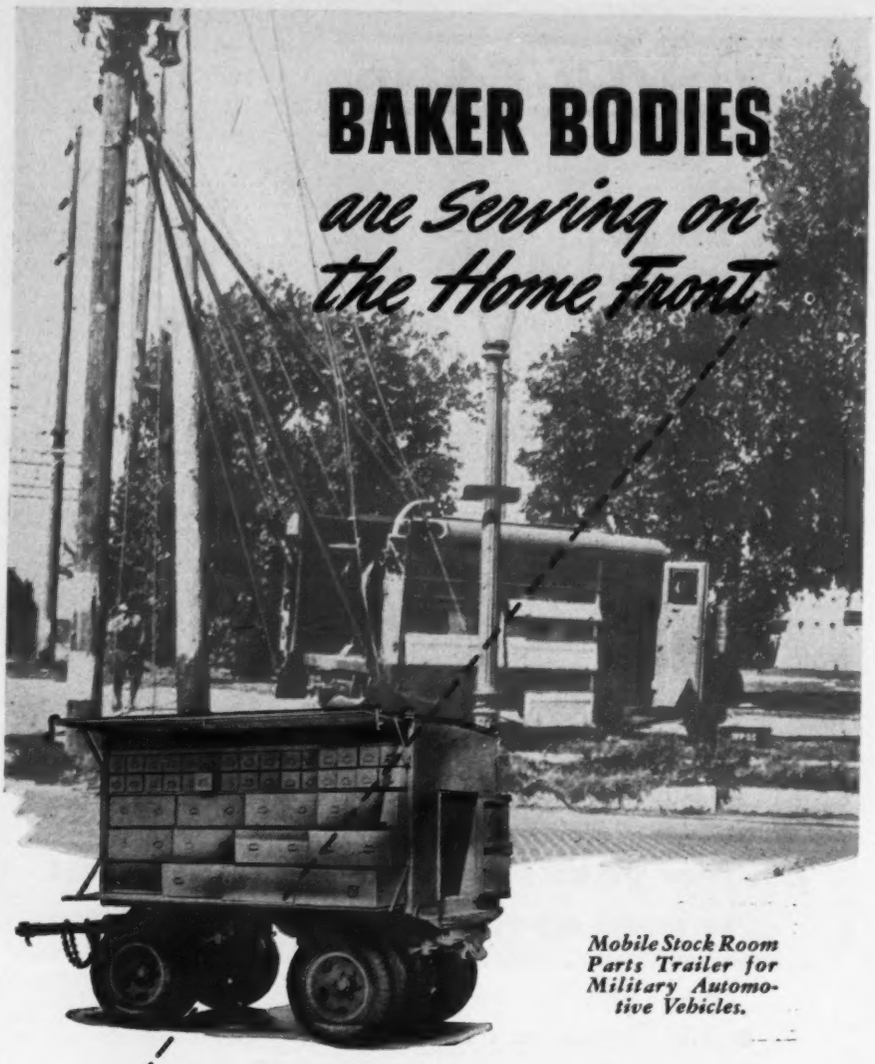
•

Lighting Unit

Designed for use in offices and drafting rooms, fluorescent unit has etched ribbed glass for side panels to prevent glare and open louvers in the bottom of the unit to prevent direct view of the lamp. Construction is of all-steel except louvers and is said to provide easy maintenance as there are no horizontal surfaces on which dust can collect. Lamp replacement is provided by a hinging arrangement of the louvers. Ballasts are mounted in an inverted position within the channel and are only partially enclosed.



"Beacon" fluorescent lighting unit: available for stem suspension or with close-up mounting for low ceiling areas. The F. W. Wakefield Brass Co., Vermillion, Ohio



Mobile Stock Room Parts Trailer for Military Automotive Vehicles.

and on the Battle Front

Building special truck bodies has been our business for nearly half a century. Our major peacetime activity supplies Public Utilities with all-steel truck bodies and equipment designed to facilitate maintenance. It is only natural that Baker should today be called on to supply specialized truck bodies and trailers required for maintaining essential fighting equipment.

All our production facilities are today devoted to war work. At the same time our engineers are designing new utility equipment for post war. Let us know your needs today, to speed the return of your service and ours to normal standards.

BAKER UTILITY BODY DIVISION
of The Baker-Raulang Co.
1284 WEST 80th STREET • • CLEVELAND, OHIO

Dependable AS THE SERVICE THEY HELP TO MAINTAIN
Baker BODIES AND EQUIPMENT FOR EVERY UTILITY PURPOSE

● Top illustration shows the hinge end of a C-W Switch made during an ice test. The switch was warm, approximately 70°, when the spray was started and the ice deposit represents a six hour accumulation. A gradually applied pull of 60 lbs. on a 28 inch lever cracked the ice at the hubs of the cranks and freed the mechanism.

The lower picture shows the switch closed into contact through a heavy deposit of clear ice. The switch was closed at the speed of motor operation. This contact housing is not only a sleet hood but is also designed for ice breaking.

For dependable protection specify Hi-Voltage Air Break Switches.

HI-VOLTAGE
EQUIPMENT COMPANY
2891 East 79th Street • Cleveland 4, Ohio

TECHNICAL LITERATURE

TUBULAR BUS—Specialized technical information, beam formulas for computing mechanical characteristics of rigid buses, theoretical vertical deflections of 10-ft. spans of rigid bus-bar with and without ice, physical and electrical properties of I.P.S. aluminum, copper, and steel tubing, are tabulated in "Connectors and Bus Support Clamps," Cat. 525, issued by Southern States Equipment Corp., 28 South 20th St., Birmingham, Ala.

CABLE SHEATHING—A report of tests made on "Fracture and Ductility of Lead and Lead Alloys for Cable Sheathing" conducted by University of Illinois Engineering Experiment Station, Urbana, Ill., in cooperation with the Utility Research Commission. Included are the testing methods, materials, tables, curves with special attention given to notches in and the greasing of the lead sheath metal. This 64-page bulletin is No. 347, obtainable from the university at 70 cents.

THERMOCOUPLES—Recommendations for thermocouple users, suggested substitutes for restricted materials, instructions for checking thermocouples and pyrometers and on construction of thermocouples, data on selection of thermocouples, lead wire, protecting tubes, heads and insulators, millivolt tables and wire resistances are included in Bulletin S2-4, "Wheelco Thermocouple Data Book and Catalog" obtainable from Wheelco Instruments Co., Harrison and Peoria Sts., Chicago 7, Ill.

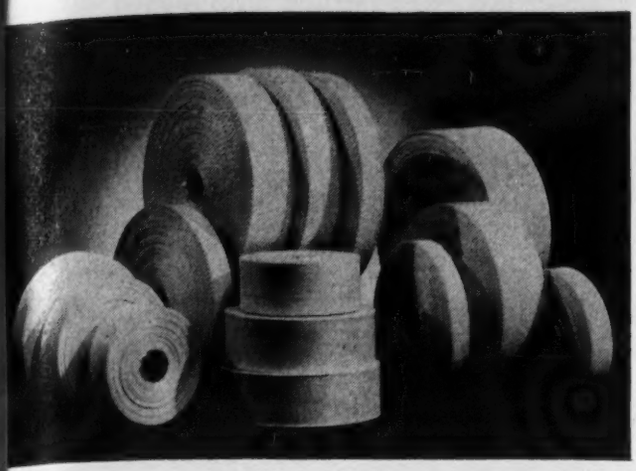
INDUCTION HEATING—A 32-page booklet entitled "The Tocco Process" explains the underlying principles and metallurgy of the induction process and discusses other subjects such as superhardness, surface hardening, heat-treating, normalizing and annealing, and brazing and soldering. Copy of Bulletin No. 15 is available from the Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

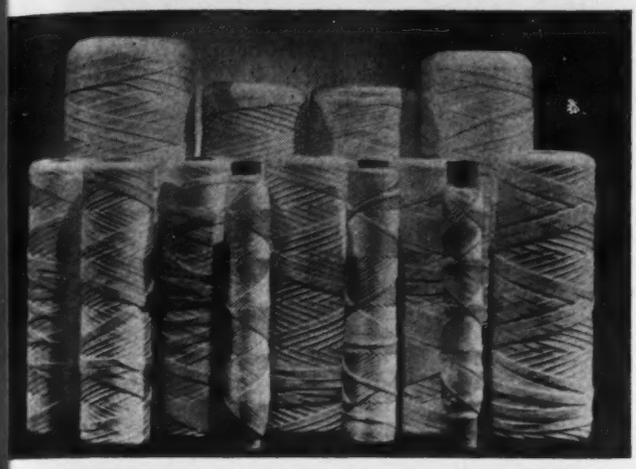
BOILERS—Operating data and illustrations on the S-A type boiler used in various plants, method of operation, ability to fire two or three different fuels simultaneously, and an extended and simplified chart giving heat content of steam, are contained in Bulletin B-44-5-M, entitled "S-A Boilers," available from Foster Wheeler Corp., Department M, 165 Broadway, New York 6, N. Y.

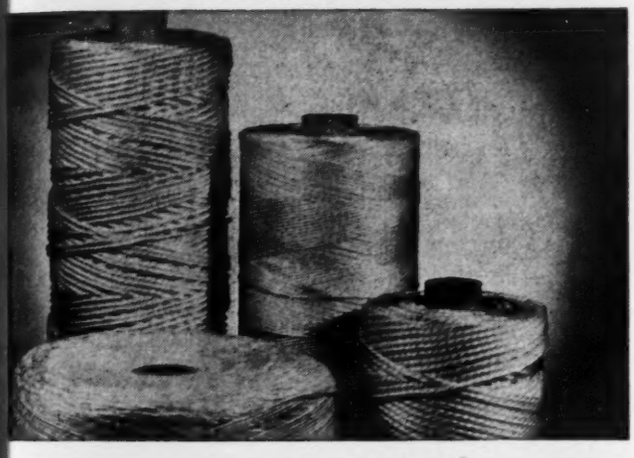
VARNISHES—To counteract inefficient methods of insulating electrical units with varnish, the John C. Dolph Co. has issued a poster containing seven simple rules and a benzine solvent chart. The poster may be obtained from the company, Department 20, 168 Emmet St., Newark 5, N. J.

THERMOMETALS, electrical contacts including powder metal contacts, precious metal collector rings and brushes, and wire, are discussed in the 1944 edition of the Wilco Blue Book. Data, formulas and charts are given on each metal to aid in the selection of the proper type. Copy of the 88-page publication may be obtained from the H. A. Wilson Co., 105 Chestnut St., Newark 5, N. J.

"DEGASIFICATION OF WATER" is a bulletin which describes and illustrates means provided for removal of oxygen, carbon dioxide, ammonia, hydrogen, sulphide from water at various temperatures. Bulletin 4076 can be obtained from Cochrane Corp., 17th and Allegheny Ave., Philadelphia 32, Pa.







Fiberglas* properties

—*helpful in solving problems in electrical insulation*

Fiberglas is glass. It will of itself withstand temperatures far in excess of any requirements of an electrical insulation. But high heat resistance is only one of its many basic properties.

Low space factor (thinness) combined with high tensile strength make Fiberglas highly desirable in many applications in which its high-temperature characteristic has value only as a safety factor . . . In textile form, Fiberglas is available in thicknesses down to 2 mils (.0020″).

Fiberglas is resistant to moisture, most acids, oils, corrosive vapors. Again, these properties make it highly desirable for electrical use where high heat resistance is important only as a safety factor.

In textile form, Fiberglas is a good conductor of heat. This property also permits its use in many electrical applications.

And, of course, Fiberglas is permanent. It does not deteriorate with age.

Treated and Untreated Forms

Untreated Fiberglas is available as cloth, tapes, sleeving, and cord.

In treated forms, Fiberglas is available as varnished cloth and tapes; combination Fiberglas-and-mica sheets and tapes; pressure-sensitive tapes; single, double, and triple saturated sleeving; varnished tubing; and laminated Fiberglas sheets, sticks, or wedges.

Fiberglas-covered magnet wire, lead wire, and other wires are obtainable from leading wire manufacturers.

Fiberglas is now available for immediate delivery. Increased production facilities make this possible. Consult your electrical distributor. *Owens-Corning Fiberglas Corporation, Toledo 1, Ohio, Fiberglas Canada, Ltd., Oshawa, Ont.*

FIBERGLAS
*T. M. Reg. U. S. Pat. Off.

ARMY E NAVY

YARNS • TAPES • CORD • SLEEVING
CLOTH and OTHER FORMS

NEWS ABOUT PEOPLE

New Westinghouse Executives Take Office

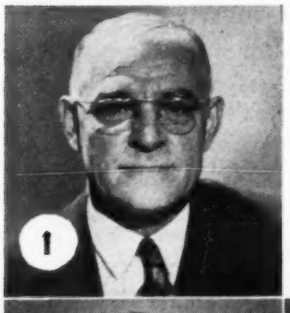
The four men, who took office last week as new vice-presidents of the Westinghouse Electric & Manufacturing Co. (ELECTRICAL WORLD, May 6, page 17) have all been associated with the Westinghouse organization for many years. They included R. A. Neal, J. H. Ashbaugh, J. K. B. Hare, and H. H. Rogge.

Mr. Neal, who becomes vice-president and sales manager, reporting to B. W. Clark, vice-president in charge of all sales activities of the company, was formerly manager of the switchgear division at the East Pittsburgh works. As a leader in the development of switchgear apparatus for controlling electric power, Mr. Neal has fostered improvements in electrical equipment, which have helped power companies to meet the increasing demands for electric power at steadily decreasing cost to consumers. He has been associated with Westinghouse switchgear activities since completion of a two-year graduate engineering student course at the East Pittsburgh works. In 1926 he was appointed manager of switchgear apparatus, five years later he became manager of the central station department and in 1939 he was appointed manager of the switchgear division.

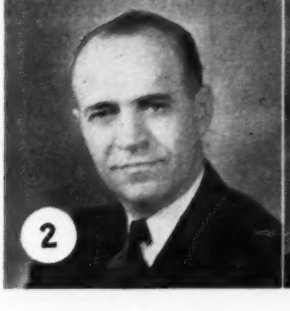
Mr. Ashbaugh has been serving in the capacity of manager of the company's electric appliance division, with headquarters in Mansfield, Ohio, since 1942. His responsibilities will remain unchanged. Starting with Westinghouse in 1918 as a student engineer in the East Pittsburgh Works, he was assigned to the company's activities in the comparatively new field of instruments for aircraft wireless sets. Next he worked on meters and relays and the development of voltage control apparatus for power houses and industrial applications. He was transferred to the company's electric appliance division in 1931 as assistant manager of engineering at the Springfield (Mass.) Works. In less than a year he was named manager of engineering at that plant. In 1941, he was appointed manager of manufacturing and engineering of the electric appliance division.

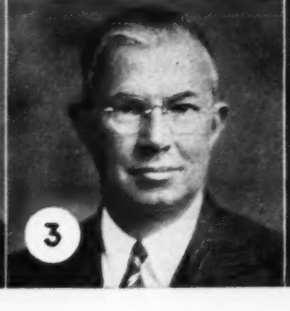
Mr. Hare, who has been manager of the central district sales activities with headquarters in Pittsburgh, since 1938, joined the staff of the Pittsburgh sales office of the company in 1919 and in 1928 was appointed manager of the central station and transportation divisions in the Pittsburgh central office. He was transferred to the company's Buffalo office as manager in 1935 and then went to the central district. Under his new assignment, his duties remain unchanged.

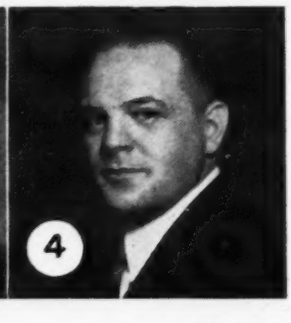
Mr. Rogge, manager of the company's Government office, will continue to make his headquarters in Washington for the time being. Mr. Rogge joined Westinghouse as a supervisor of rates in the Brooklyn plant in 1922, being transferred two years later to the New York office as switchgear engineer. In 1925 he was named general engineer in that office. Transferring to the Westinghouse Electric International Co. in 1926, he was assigned as special representative in the Philippines, later opening Westinghouse offices in several places in the Far East. He was named New York sales manager of the International company in 1934 and two years later was promoted to manager of all sales activities for that company. In 1939 he was transferred to Westinghouse Electric & Manufacturing Co. at Pittsburgh and was named manager of the Washington office in 1940.



1 R. A. Neal
2 J. H. Ashbaugh
3 J. K. B. Hare
4 H. H. Rogge







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New Appointments Made by Oklahoma Utility

J. A. Whitlow, for the past 20 years Tulsa district manager for the Public Service Co. of Oklahoma, has been appointed head of the company's employee education and information department. C. N. Robinson, vice-president and formerly head of the company's new business department, has been appointed Tulsa district manager and Leslie E. Bates, Jr., becomes assistant Tulsa district manager.

Dallas J. Frandsen, formerly head of industrial power service, was promoted to Mr. Robinson's departmental position. The department will be known as the sales development department and Mr. Frandsen will be in charge of sales in the eastern division.

Wright Canfield, engineer, was named director of a newly created research department, with supervision over rates and research. W. D. McGinley, formerly rate engineer and more recently acting manager of the Bartlesville district, was named manager of the Bartlesville district.

•

▶ CYRUS BARNES, for many years general sales manager of the utilities formerly grouped under the management of the then Charles H. Tenney & Co. interests, at Boston, later assistant to the merchandising manager of the New England Power Service Co., Boston, and recently assistant to the president, Malden (Mass.) Electric Co., resigned as of May 1 to enter private business.

▶ LT. PAUL J. LAZARD has been appointed chief of the public utilities section of the Metropolitan French Mission, an element of the delegation in the United States of the French Committee of National Liberation. Lt. Lazard, a graduate of the Mining

Yesterday *wouldn't get much of a reception* TODAY

TOMORROW

Yesterday's radio would fall far short of doing justice to today's broadcasts. Few of us would have the patience to fool around with numerous dials to keep a station tuned in properly. Improved Electrical Insulating Materials have made an important contribution to the performance of today's radios, whether in use by our Armed Forces or by civilians.

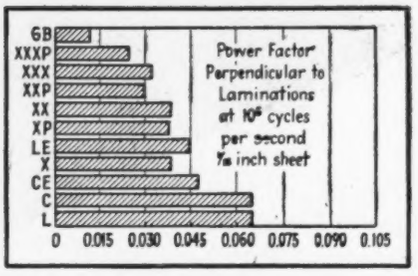
The C-D Laboratory has made it unnecessary for Electrical and Design Engineers to "fool around" experimenting with numerous types of electrical insulating materials. C-D has developed grades and types of electrical insulating materials to meet specific and special problems. The "know-how" accumulated through solving thousands of electrical insulating problems is at your disposal to help you solve the question "What Insulating Material?"

CC-43

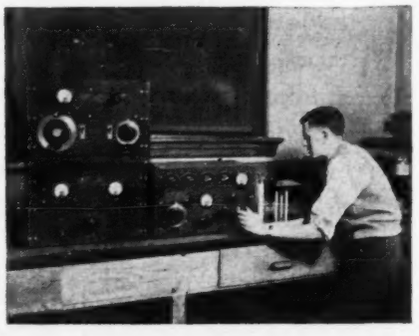
POWER FACTOR VALUES IN DILECTO Laminated Phenolics*

Power factor may be considered an indication of the stability of the insulating material in question or a check of the uniformity of specimens. In some cases it is desirable to have low power factor, while in others it is not so important. In all cases, however, it is a useful means to indicate purity of composition and useful life under electrical stresses, as well as the efficiency of the insulator.

POWER FACTORS FOR STANDARD DILECTO GRADES



One of the standard test methods for power factor is called the "Resonant Circuit; Resistance Variation Method." Measurements are at 10^6 cycles per second. Equipment consists of a stable high-frequency generator, a vacuum tube voltmeter, decade resistors and a standard precision-type variable air condenser. Below, Mr. Freed is seen operating this equipment.



* Excerpts from an article on POWER FACTOR TESTS by J. R. Freed of the Continental-Diamond Laboratory Staff. A copy of the complete article will be sent on request.

Continental-Diamond FIBRE COMPANY

Established 1895.. Manufacturers of Laminated Plastics since 1911—NEWARK 15 • DELAWARE

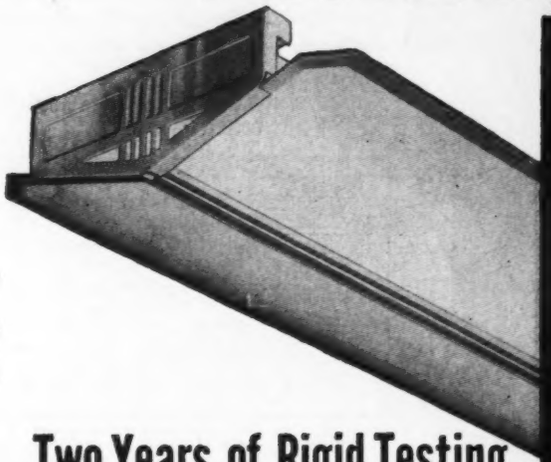
Guth

In 1942--We Introduced

QUICK-LITER*

The Original Starterless

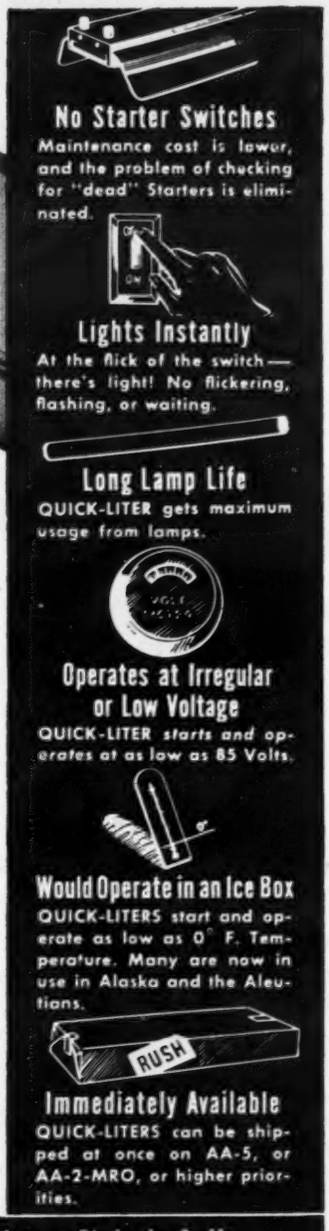
FLUORESCENT!



Two Years of Rigid Testing Have Proved Its Worth!

The GUTH QUICK-LITER was originated for War Plants; where high maintenance costs due to Starter-Switch troubles, and variable line-voltage conditions, made *Starterless* Fluorescent desirable. Detailed performance records were maintained, so that every claim made for QUICK-LITER has been *proved* by use.

A valuable report on the results of these tests is now available. Write for your copy today.


No Starter Switches
Maintenance cost is lower, and the problem of checking for "dead" Starters is eliminated.
Lights Instantly
At the flick of the switch—there's light! No flickering, flashing, or waiting.
Long Lamp Life
QUICK-LITER gets maximum usage from lamps.
Operates at Irregular or Low Voltage
QUICK-LITER starts and operates at as low as 85 Volts.
Would Operate in an Ice Box
QUICK-LITERS start and operate as low as 0° F. Temperature. Many are now in use in Alaska and the Aleutians.
RUSH
Immediately Available
QUICK-LITERS can be shipped at once on AA-5, or AA-2-MRO, or higher priorities.

Guth *QUICK-LITER
TRADE MARK

The Edwin F. Guth Co. • 2615 Washington Ave. • St. Louis 3, Mo.

School of Paris and a specialist in public utilities, brought from France in 1941 a method of low-frequency street-lighting and other remote control, the operation of which was successfully demonstrated in this country. The method was described by Lt. Lazard in ELECTRICAL WORLD article, December 27, 1941, page 84.

•

Hendy Appoints Johnson General Sales Manager

Wallace Johnson was recently appointed general sales manager of the Joshua Hendy Iron Works at Sunnyvale, Calif. With an engineering as well as a

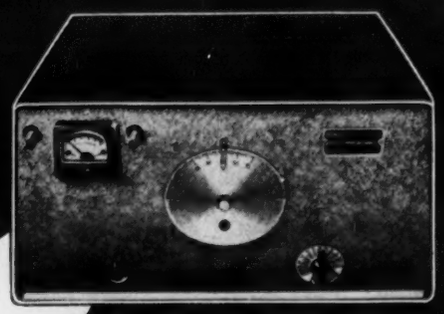
sales background, Mr. Johnson comes to his new position well qualified to direct the sales of this western manufacturer.

A graduate of California Institute of Technology in mechanical engineering, Mr. Johnson has been associated with Charles E. Moore, president of Hendy, for a number of years, first with the Moore Machinery Co., and subsequently with the Autometric Machine Tool Co., then the Production Engineering Co. of Berkeley, Calif. In 1942 Mr. Johnson joined the Hendy organization. His work has included several months at the Crocker-Wheeler division at Ampere, N. J., in the capacity of assistant to Mr. Moore; several months as an administrative head at Sunnyvale; and since June, 1943, until his recent appointment, he has been assistant general manager of the Pomona Pump Division at Pomona, Calif.

•

► FRED A. HUBBARD, electrical engineer, New Bedford (Mass.) Gas & Edison Light Co., has been elected chairman of the electrical equipment committee of New England, an organization of utility engineers meeting periodically to dis-

FOIL THE SABOTEURS



Give critical plants the protection of Browning Signal System, with its balanced-capacitance electronic circuit, which saturates vulnerable areas and releases guards for productive duty. Pre-Pearl Harbor installations have proved efficient, dependable, economical.

Browning Frequency Meters are accurate to .005%. Pre-check public utility and other emergency radio systems. Assure signal clarity.

ILLUSTRATED LITERATURE UPON REQUEST

BROWNING

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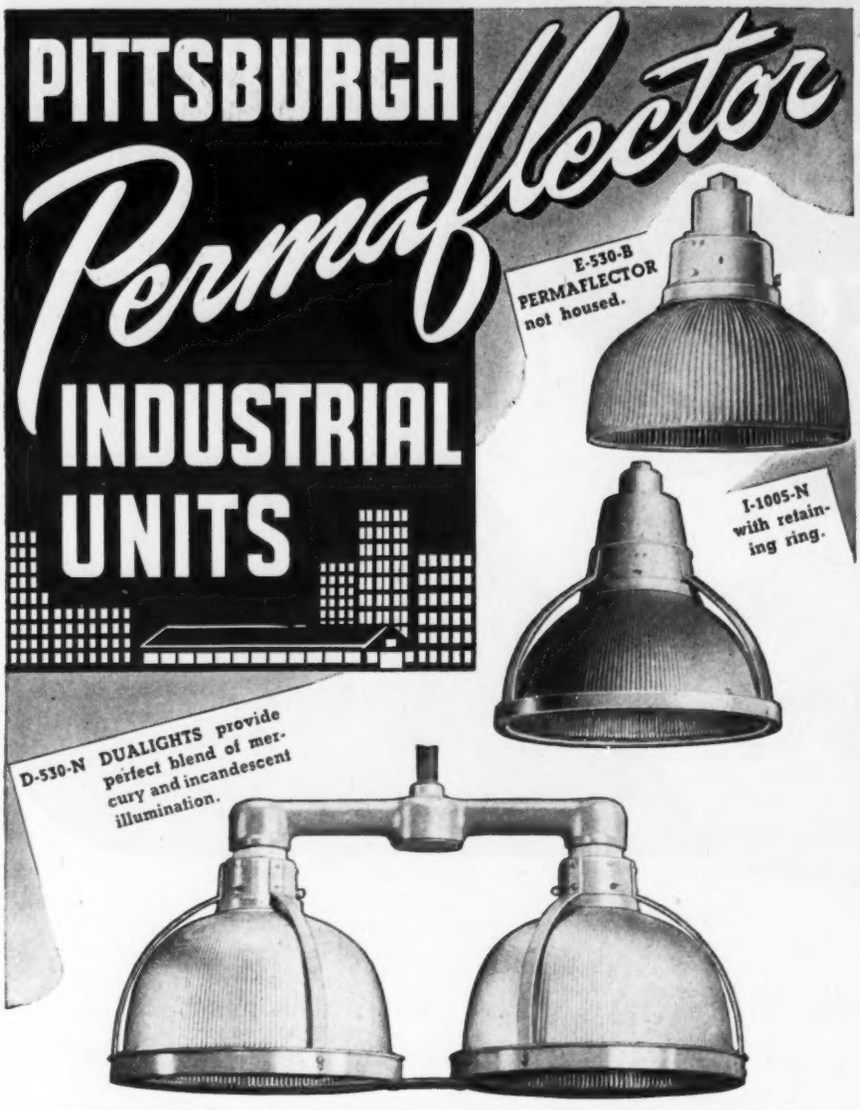
WINCHESTER, MASSACHUSETTS

PITTSBURGH Permaflector INDUSTRIAL UNITS


E-530-B PERMAFLECTOR not housed.
I-1005-N with retaining ring.
D-530-N DUALIGHTS provide perfect blend of mercury and incandescent illumination.

Permaflector silvered-glass units provide highly efficient, engineered light control for every industrial lighting requirement . . . general or localized . . . ceiling or sidewall installation . . . high or low bay mounting . . . for medium, broad, or concentrated distribution . . . for lamp wattages of 100 to 1,500 watts . . . with incandescent, mercury vapor lamps, or a combination of both . . . mounted as single units or on dual hangers. Sold on priority thru Electrical Wholesalers.

FLOODLIGHTS

Rugged in construction · weather-proofed and corrosion-resistant · equipped with famous silver-mirrored glass Permaflectors. Available in 200 to 1,000 wattages, and broad, intermediate or concentrated light distributions. Complete. Ready to set up.

PITTSBURGH REFLECTOR CO.
OLIVER BLDG., PITTSBURGH, PA.

ILLUMINATING ENGINEERS DESIGNERS & MANUFACTURERS of COMMERCIAL & INDUSTRIAL LIGHTING EQUIPMENT

* Now producing confidential lighting equipment for the Armed Forces and supplying Industrial users on priority (Commercial replacements from stock). Startling new post-war developements now in work will soon be announced.

cuss design and operating problems, and FRANK R. LONGLEY, electrical engineer Western Massachusetts Electric Co., Springfield, has been elected vice-chairman. R. D. HARRINGTON, Electric Storage Battery Co., Boston, continues as secretary.

PAUL R. OLDENBERG, who recently became system betterment engineer for the Pacific Power & Light Co., Portland. Formerly distribution planning engineer for the Duquesne Light Co., Pittsburgh, Mr. Oldenberg had been with the Pittsburgh utility for 20 years in various capacities.

▶A. J. SHAVER of Winnemucca, Nev., has been appointed engineer of the Colorado river commission to fill the vacancy created by the death of Charles DeArmond. For the past seven years Mr. Shaver has been manager of the Western States Utilities Co. in Winnemucca and was previously associated with Sierra Pacific Power Co. in Reno.

▶JOHN J. DOYLE, superintendent of the wiring and maintenance division, service and repair department, Commonwealth Edison Co., Chicago recently retired after 39 years of company service. He is succeeded by LEROY CHOATE, formerly assistant superintendent.

▶W. FRED STEVENS, formerly senior engineer, Office of War Utilities Inventory Control Branch, Region 6, Chicago, has been named regional engineer, succeeding A. I. WALLACE who is now liaison officer between the Chicago district office of WPB and the War Manpower Commission. Mr. Stevens was formerly engaged in private consulting and appraisal work in Chicago. From 1923 to 1930 he was president of the East Coast Utilities Co., Richmond, Va. Prior to 1923 he was vice-president of the Interstate Power Co., Dubuque, Iowa. He joined the Iowa utility company upon his return from the Army follow-

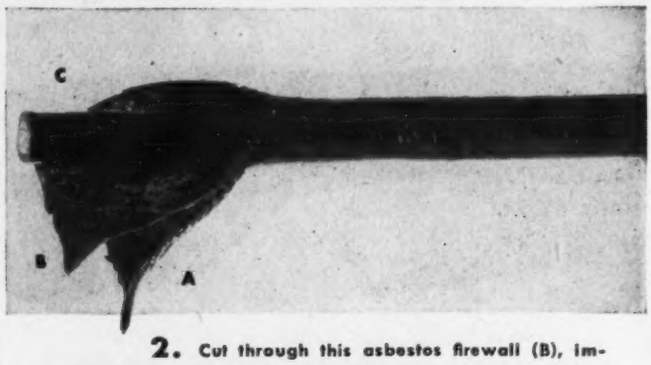
Don't take our word for it —

MAKE THIS SIMPLE TEST AND SEE FOR YOURSELF

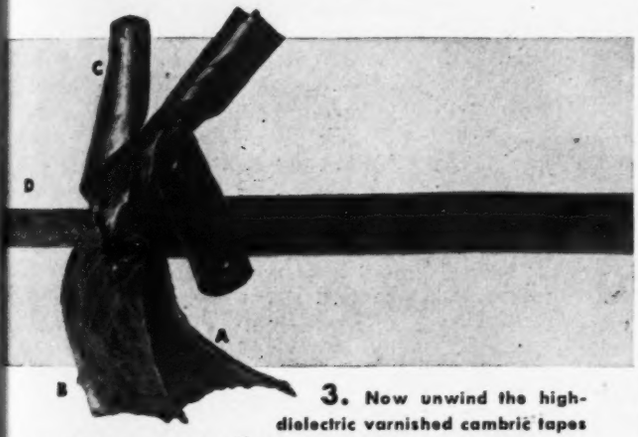
Why PERMANENTLY INSULATED ROCKBESTOS A.V.C.

Gives Long-Lived Service Under Severe Operating Conditions

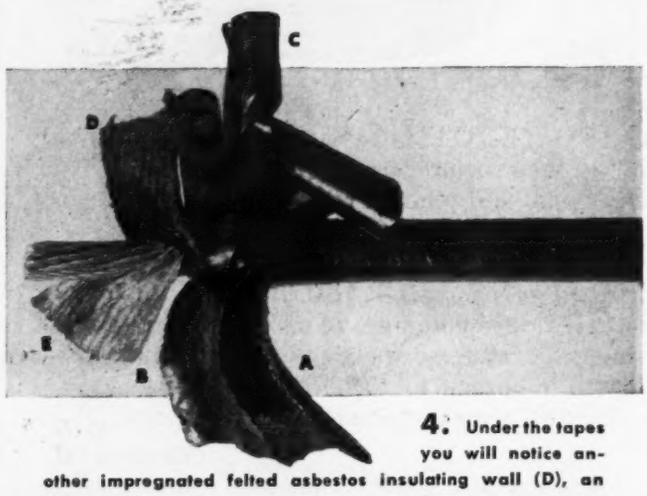
1. Take a sample of Rockbestos A.V.C. Motor Lead Cable (illustrated), or similarly insulated Power Cable, slit open the slick-finished, heavy asbestos braid (A) impregnated with heat, flame and moisture resisting compounds — a braid that won't dry out, crack or flow under heat; won't bloom, swell or rot as a result of contact with oil or grease; and won't burn or carry flame — and beneath it you will find a firewall of felted asbestos (B).



2. Cut through this asbestos firewall (B), impregnated like the braid, but felted into a permanent insulation that is resistant against heat, flame and moisture — an insulation that won't burn, bake brittle or crack with vibration — and next you'll see the lubricated varnished cambric tapes (C) which it protects from high ambient temperatures and oxidation.



3. Now unwind the high-dielectric varnished cambric tapes (C) and you will see the obvious advantages of helical construction — for uniform coverage, for dielectric stability, and to assure, together with the helically applied felted asbestos, perfect and permanent centering of the conductor in the insulation.



4. Under the tapes you will notice another impregnated felted asbestos insulating wall (D), an inner heat-barrier put there to complete the protection of the varnished cambric from the heat of conductor overloads. Slit and peel back this felted wall and beneath you'll find a thin wrapping of paper (E) over the conductor to keep it clean and make stripping easier.

Try the simple test outlined above on a sample of Rockbestos A.V.C. cable, which we will send on request, and you'll readily see why permanently insulated Rockbestos A.V.C. wires, cables and cords resist heat, flame, moisture, corrosive fumes, oil and grease — and give long-lived service under high temperatures and severe operating conditions. Write:

ROCKBESTOS PRODUCTS CORPORATION
942 Nicoll St., New Haven 4, Conn.

ROCKBESTOS A.V.C.

The Wire With Permanent Insulation

122 different wires and cables have been developed for severe operating conditions by Rockbestos

FOR VICTORY — BUY WAR BONDS!

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

STRENGTH to support the pole structure under maximum ice and wind loading... RUGGEDNESS to withstand the punishment incurred in construction and service.. DURABILITY that provides a minimum of maintenance . . . all these are combined —with important ECONOMY— in *Crapo* Galvanized Steel Strand.

Each size and grade is manufactured from steel of selected analysis and processed from start to finish to perform the task for which it is specified. The heavy, ductile, tightly-bonded zinc coating—applied by the famous *Crapo* Galvanizing Process—provides lasting protection against corrosion; helps prolong the life of the strand beyond the normal period of replacement.

There is a size and grade of *Crapo* Galvanized Steel Strand for every practical need. Consult the distributor of *Crapo* Galvanized Products near you or write for further information!

INDIANA STEEL & WIRE COMPANY..... MUNCIE, INDIANA

Crapo GALVANIZED STEEL STRAND

ing World War I. Prior to 1918 he served for a time as assistant to the president of H. M. Byllesby Co., Chicago.

•

Kuhlman Electric Makes New Appointments

James E. Bevan, formerly vice-president of the Roller-Smith Co., in charge of manufacturing operations, is now district manager in charge of the New York office of the Kuhlman Electric Co., with headquarters in the

J. E. Bevan

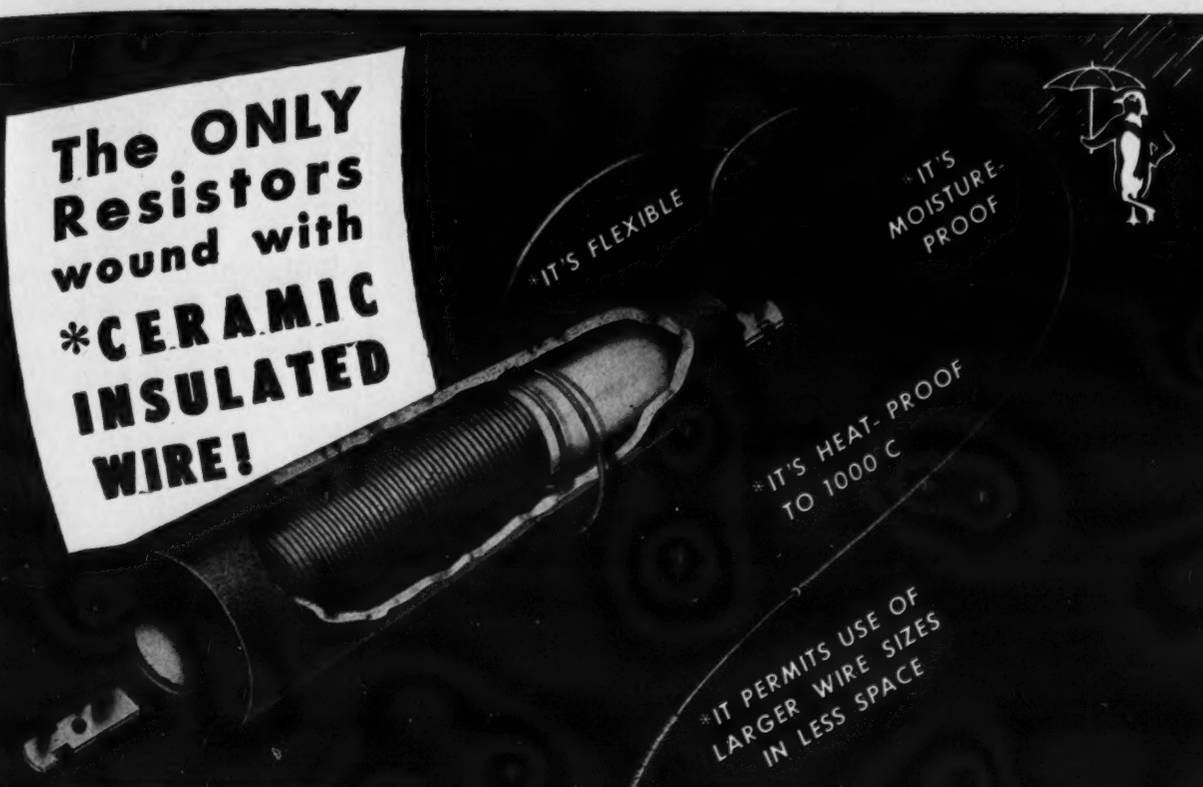
Graybar Building. In addition to the transformer business, Mr. Bevan is directing the Detroit Electric Furnace activities in connection with the sale and service of Detroit Furnaces in the Metropolitan area, including Connecticut, New Jersey, etc.

A. H. Ellerman has also joined the staff of Kuhlman Electric in the capacity of assistant sales manager, transformer division in the Bay City (Mich.) office. Mr. Ellerman has been with WPB in the transformer section for almost two years.

•

▶ WALTER P. ARNOLD, technical director of Koppers Company, wood preserving division, was elected president of the American Wood Preservers' Association at its recent annual meeting in Chicago. Following graduation from the University of Cincinnati in 1925, Mr. Arnold joined the Pittsburgh Crucible Steel Co., Midland, Pa., as research chemist. On leaving that organization, he was appointed chemical engineer of the Wood Preserving Corp., a subsidiary of Koppers Co., with headquarters at its laboratory in Orrville, Ohio. When the Wood Preserving Corp. was merged as a division of Koppers Co., Mr. Arnold became technical director of Koppers

The ONLY Resistors wound with *CERAMIC INSULATED WIRE!



A MAJOR RESISTOR IMPROVEMENT

The outstanding superiority of Sprague Koolohm Resistors in practically every important characteristic could—and did—result only from an entirely different engineering approach to basic problems—from the wire up. Research proved that the resistor was no better than the insulation on the wire. Koolohm ceramic insulation applied to resistance wire permitted such valuable engineering features that, in less than four years, these resistors have set higher standards of performance on hundreds of the most exacting applications. Standard units include 5- to 150-watt power types, bobbin types and meter multipliers. Write for Catalog—today!

SOLVING PROBLEMS of

UNWIELDY SIZE
REDUCED WATTAGES
CHANGED VALUES
HIGH AMBIENTS
MOUNTINGS
SHORTS
...and many more!

SPRAGUE SPECIALTIES CO.
RESISTOR DIVISION
NORTH ADAMS, MASS.

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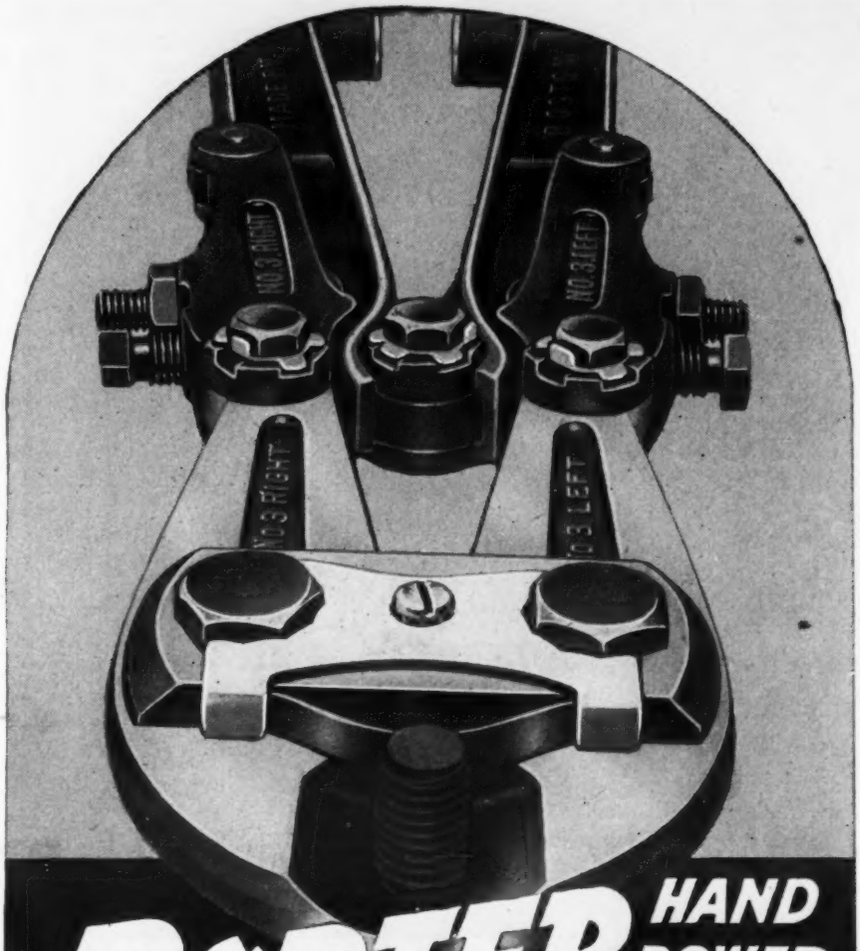
SPRAGUE KOOLOHM RESISTORS



PORTER HAND POWER CUTTERS

These tools go *to* the job and are used *on* the job independent of any power source — except a worker's two hands. This power is so multiplied that an average worker can exert sufficient pressure to " lift an elephant —."

This power delivered at the working head finds many applications in metal cutting and fabricating — emergency, repairs, on construction, shop or production.

The illustration above shows a Porter Bolt Clipper head cutting a 5/8" annealed bolt in the thread. In addition to standard tools for cutting wire, cable, chain, flat bars, splitting nuts, etc. there are special tools for Heading, Pressing, Crimping, Punching, Caulking.

FREE—Write for Free copy of Tool Maintenance Book—boiled down essence of practical experience in use and care of clippers, saws, chisels and other hand tools. A post card request will bring it postpaid. *Also write for catalog of Porter line of Cutters.*

H. K. PORTER, INC., 412 Ashland St., Everett 49, Mass.

PORTER HKP CUTTERS

Wood Preserving division, heading up research activities at its 21 wood treating plants. Mr. Arnold is a member of the American Chemical Society, American Society for Testing Materials and the National Fire Protection Association.

•

Bailey Meter Co. Elects R. S. Coffin President

At an organization meeting of the directors of the Bailey Meter Co., Cleveland, Ohio, E. G. Bailey, formerly president and company founder, was elected

R. S. Coffin

chairman, Robert S. Coffin was named to succeed him as president.

Mr. Coffin, who has been vice-president since 1925, became identified with Bailey Meter Co. as treasurer at the time of its organization in 1916.

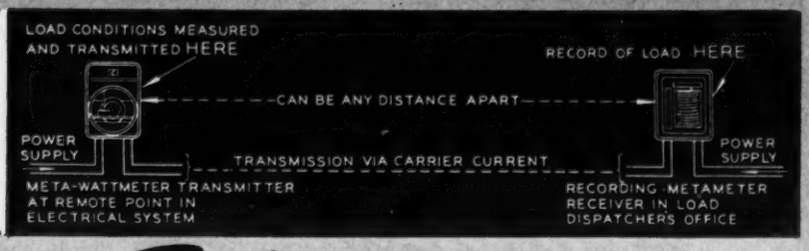
•

► HAROLD E. STRANG, for the past three years engineer of General Electric Co.'s Philadelphia Works, has been named to the staff of H. A. Winne, vice-president in charge of design engineering, apparatus department. Mr. Strang will be located in Schenectady. He joined General Electric as a test engineer at the Schenectady Works and becoming acquainted with switchgear through tests assigned to him, he was shortly placed in charge of switchboard tests. Entering the switchboard engineering department, he transferred to Philadelphia in 1929 as an application engineer. In 1932 he was promoted to managing engineer of the large power circuit breaker division and in 1940 was named engineer of the Philadelphia Works.

► BENTON J. SAUPPEE, who for many years was associated with the utility industry, and since 1942 has engaged in private engineering practice in Bowling Green, Ky., has been appointed

HOW TO SEE MEASUREMENTS

100 MILES AWAY


LOAD CONDITIONS MEASURED AND TRANSMITTED HERE
RECORD OF LOAD HERE
CAN BE ANY DISTANCE APART
POWER SUPPLY
TRANSMISSION VIA CARRIER CURRENT
POWER SUPPLY
META-WATTMETER TRANSMITTER AT REMOTE POINT IN ELECTRICAL SYSTEM
RECORDING METAMETER RECEIVER IN LOAD DISPATCHER'S OFFICE

Without Television . . .

Accurate and continuous information about power exchange over tie-lines d conditions at various load centers — supplied by Bristol Metameters — ables the system dispatcher to keep in closer contact with load changes and greatly adds to his efficiency.

A PROVED SUCCESS

oneered by Bristol, the Metameter stem is successfully operated in ndreds of installations.

Best known, perhaps, for its suc- s in carrier-telemetering voltage, rrent, power, reactive volt amperes d totalized load, it is also being tensively used for telemetering h measurements as pressure, water el, temperature, flow, mechanical tion and gate position.

SIMPLE IN CONSTRUCTION

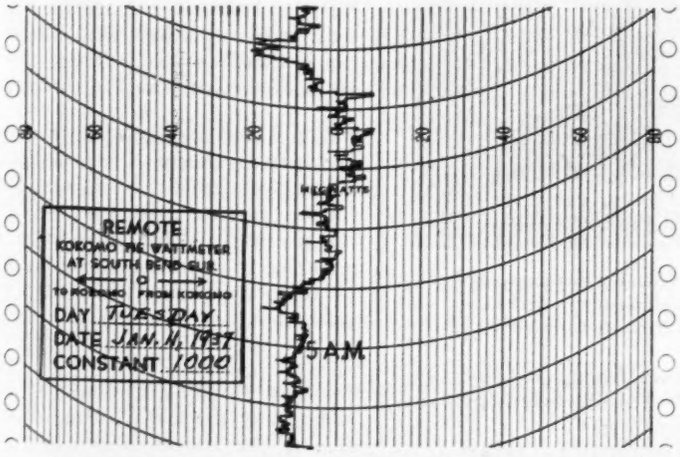
nly 3 units: transmitter, receiver d interconnecting carrier-current annel. So compactly designed are self-contained transmitter and receiver that their combined weight is less than 40 lbs.

FLEXIBLE IN APPLICATION

Bristol's Metameter operates on the impulse-duration principle of telemetering. It can be operated over the usual channels available on power systems including either unmodulated or modulated carrier current. A carrier channel, pilot relay channel or any two-wire circuit can be used.

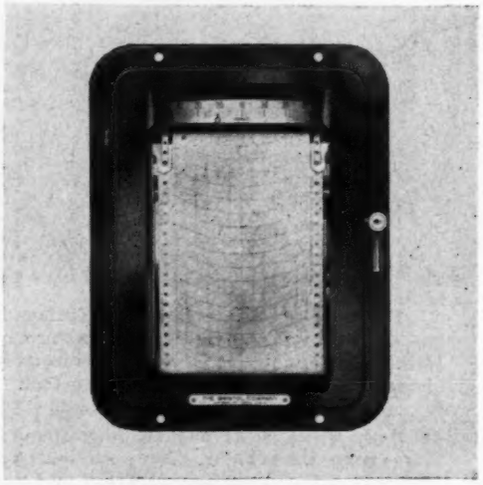
WRITE FOR LITERATURE

Bristol's Metameter system is described briefly in Bulletin M801 and in complete detail in Bulletin M1700. Either will be sent you on request.

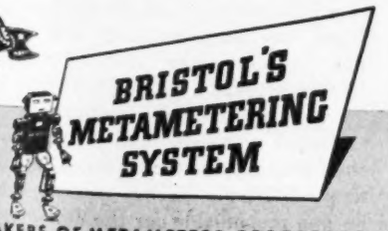


This typical chart recording was transmitted from a tie-line more than 100 miles away by carrier current over a 132 K.V. transmission line.

TRANSMITTER . . . Bristol's Model M40MT Metameter Transmitter



RECEIVER . . . Bristol's Model M28R Strip-Chart Metameter Receiver



keeps you a jump ahead of demand

THE BRISTOL COMPANY
116 Bristol Road, Waterbury 91, Conn.

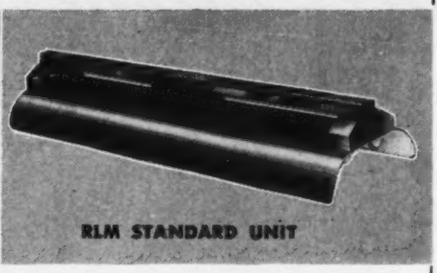
The Bristol Co. of Canada, Ltd.
Toronto, Ontario

Bristol's Instrument Co., Ltd.
London N. W. 10, England

MAKERS OF METAMETERS, RECORDING VOLTMETERS, AMMETERS, POTENTIOMETERS, THERMOVERTERS, AND A BROAD LINE OF AUTOMATIC CONTROLLING AND RECORDING INSTRUMENTS

COMPLETE LINE
For Industry's Needs
FLUORESCENT
Skilled Lighting

"SERIES II" DUST-TIGHT UNIT


RLM STANDARD UNIT

Steel DUST-TIGHT Fluorescent Fixtures for Class II "Group G & F", and Class III and IV Hazardous Locations . . . High-efficiency non-metallic Fluorescent Fixtures for standard uses . . . both provide Skilled Lighting with fluorescent lamps. These fixtures are but two examples of up-to-the-minute Wheeler engineering, backed by 63 years of experience in lighting. The DUST-TIGHT unit is advantageous where lamps, sockets and reflecting surfaces must be protected from dusts and vapors. *Standard unit*, easily adapted to continuous runs, has reflection factor not less than 85%. Made in 2 and 3-lamp 48" units; 2-lamp 60" units.

INCANDESCENT
Skilled Lighting

WHEELER VAPOLUX UNIT

RLM SOLID NECK REFLECTOR

For incandescent lighting in Hazardous Locations, Wheeler has many fixtures. Among them is the Vapolux fixture, offering top efficiency in every detail. Dust-tight and vapor-proof, it is made in standard styles for 100-500 watt lamps. Highly durable and easy to install.

Wheeler RLM Solid Neck Reflectors provide maximum lighting efficiency. Made in dome, angle and all other standard types. One-piece construction gives rugged, trouble-free service indoors or out. 75 to 1500 watts.

These are a few examples of the high-efficiency light engineering — Skilled Lighting — which Wheeler had developed to give maximum visual accuracy for workers. Write for full details on the complete line of fluorescent and incandescent fixtures. **Wheeler Reflector Company, 275 Congress Street, Boston 10, Mass.** New York, N. Y. . . Representatives in principal cities.

Distributed Exclusively Through Electrical Wholesalers

Wheeler REFLECTOR COMPANY
Lighting Equipment Specialists Since 1881

district sales manager of American Machine & Metals, Inc., East Moline, Ill. Following graduation from the University of Michigan, Mr. Sauppee was employed as power sales engineer for Rochester Gas & Electric Corp. and later engaged by Binghamton Light, Heat & Power Co. to organize and manage an industrial sales department. In this position he directed both power and lighting sales. He subsequently became associated with Kentucky-Tennessee Light & Power Co., Bowling Green, Ky., and after serving in various capacities in their sales and operating departments, was appointed to the position of superintendent of operations. It was after this connection that Mr. Sauppee established a private engineering practice.

•

A. F. Rucks Elected Head of C. J. Tagliabue Co.

At a recent meeting of the board of directors of the C. J. Tagliabue Manufacturing Co., Brooklyn, N. Y., A. F. Rucks was elected president and general manager, to succeed the late C. D. Waters. Mr. Rucks has been associated with the company for more than 30 years, during which time he has held a number of important positions in the organization. At the same meeting, J. T. Kottcamp, vice-president of the Johns-Manville Products Corp., was elected to the board of directors of the company.

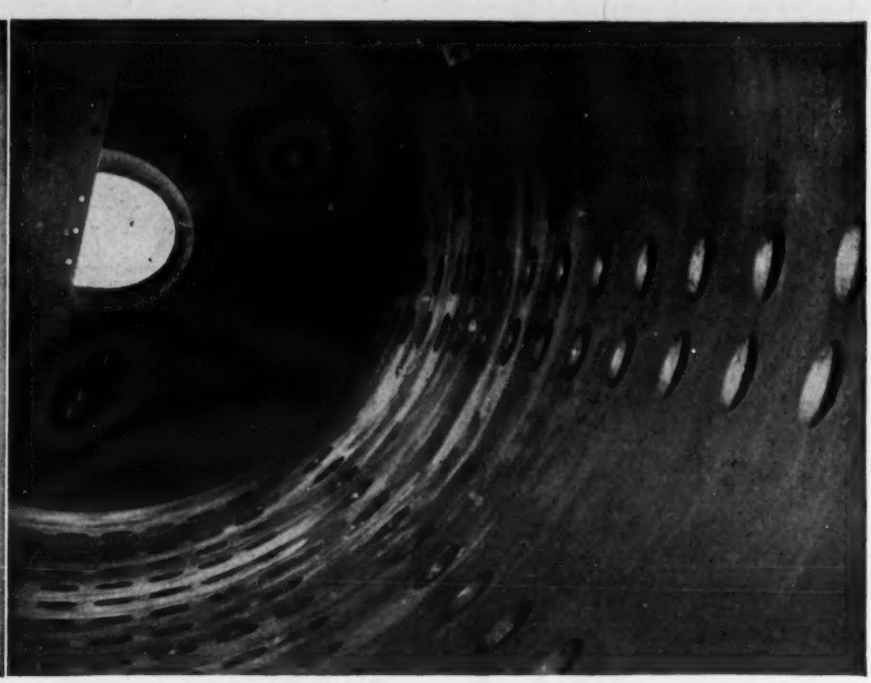
•

▶ R. H. BARNARD has resigned as executive vice-president and director of the Owens-Illinois Glass Co. after 23 years of service with the company.

▶ R. L. LEWIS has joined the staff of the Economy Equipment Co. and will operate in both the St. Louis and Kansas City territories. He attended Finlay Engineering College in Kansas City, majoring in steam engineering, and has 14 years experience in heating, steam production and combustion in the Kansas City area.

▶ FRANK M. BLUM has been appointed manager of the P.&H. crane sales division of the Harnischfeger Corp., Milwaukee, to succeed BEN VAN HORN, who, after 47 years continued association with the company, has retired. Mr. Blum has been assistant manager of the division since 1938. He joined Harnischfeger in 1929. In a short time he was made chief draftsman of the electrical division, and subsequently chief engineer of the electrical application division, under which set-up he was responsible for the development and application of electrical equip-

Scrap?... Reduce Pressure? ...No, APEXIORIZE!



APEXIOR GIVES BOILER METAL YEARS OF EXTRA SERVICE

Looks, fortunately, are often deceiving. oilers that appear to be ready for the rap pile or for operation at reduced ressure, have often been restored to ood operating condition by APEXIOR. they can pass inspection and a hydro- atic test, this long-lasting, corrosion- esistant, scale-resistant covering will peg" that condition for more years of ood performance.

APEXIOR seals up the pores and ints. It is applied with a hand brush power coater after cleaning down to are metal. One application lasts 2 to years, and is easily renewed when orn too thin for protection. APEXIOR kes the wear . . . not the metal.

RECOMMENDED BY BOILER INSURANCE COMPANIES

Painting boiler metal is recommended by boiler insurance companies. Hundreds of industrial power plants, utilities, railroads and marine operators have been following their suggestions. And manufacturers of turbines coat shafts, rotor bodies and frequently interiors of casings with APEXIOR to lengthen the life of the metal and to facilitate its periodic cleaning.

So, before you start worrying about how to replace your aged equipment, have it tested . . . then APEXIORIZE if it passes the examination.

APEXIOR is a safe, sure answer to lack of new equipment . . . the solution to your problem of getting more out of your present equipment.

Save metal . . . extend time between boiler cleaning . . . make cleaning easier . . . APEXIORIZE.

Users like these have applied APEXIOR for years

It will help you get more service from irreplaceable equipment

The Solvay Process Co.
Ingersoll-Rand Co.
Puget Sound Power & Light Co.
Rockefeller Center, Inc.
Yale University
New York Central System
Chatham Manufacturing Co.
Pennsylvania Sugar Co.
Federal Shipbuilding & Dry Dock Company
Aluminum Co. of America
Allis-Chalmers Mfg. Co.

Ease of applying APEXIOR explained—Cleaning simplified. Write, today for Bulletin 1290 (Industrial) or 1305 (Marine) telling how to get peak production with peak protection.

APEXIOR

A Peacetime Plus ★ ★ ★ A Wartime Must

RECOMMENDED BY ALL U. S. AND CANADIAN BOILER INSURANCE COMPANIES

The **DAMPNEY COMPANY of America**
protective coatings for
STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

THE DAMPNEY COMPANY OF AMERICA
Hyde Park 36, Mass.

Please send free Bulletin 1290 (Industrial) ☐ 1305 (Marine) ☐

Name.....

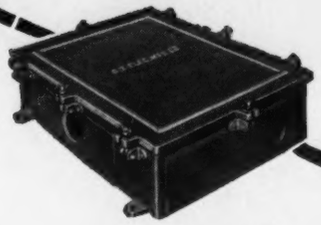
Company.....

Address.....

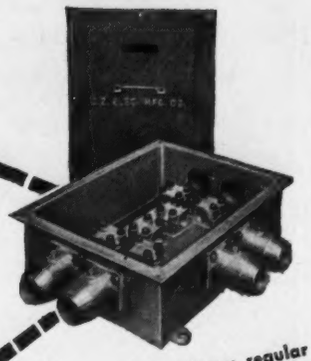
ain Office: **HYDE PARK • BOSTON • MASS.** • *Branch Offices:* **ATLANTA • CHICAGO • NEW YORK • DETROIT • PHILADELPHIA**

ngineering Sales Representatives — Pittsburgh, Cincinnati, New Orleans, San Francisco, Los Angeles, Portland, Seattle, Phoenix, Denver, Salt Lake City, Dallas, Houston, Vancouver, B. C., Montreal, P. Q., Havana, Cuba, Honolulu, T. H., Marine Dept., 114 Liberty Street, New York City, N. Y.

O.Z. NOW OFFERS A COMPLETE LINE OF CAST IRON JUNCTION BOXES



This weatherproof pull box can be used with cut-outs, terminal strips, or other equipment. One piece rubber gasket in the groove of the cover makes a water-proof box.



An adaptation of one of our regular boxes fitted with an O. Z. distribution center and flanged wiping caps.

Heavy Duty Type Junction Box. Can be used for surface or flush mounting. Available with rubber gasket (as shown) or with raised cover for heavy explosion-resisting work.

For use in the building of railways, subways, docks, bridges, industrial plants, highways and underground systems, a completely new line of O. Z. Cast Iron Junction Boxes is now available. Its wide variety of standard units meets any regular demand, while unusual demands can be met by O. Z. Junction Boxes manufactured to your specifications.

In these boxes, you benefit by O. Z.'s quarter-century experience in the manufacture of electrical fittings. In them, you get typically O Z. attention to detail and quality standards. All boxes are constructed of close-grain gray iron castings of machinable quality.

This new Flange Type Wiping Cap has been added to the regular O. Z. Wiping Cap line. Adaptable for use with Junction Boxes.

FULL DESCRIPTION of these junction boxes, with dimensions and catalog numbers of standard types is found in O. Z.'s new 144-page illustrated catalog—along with similar information on more than 160 O. Z. fittings including **CONDUIT FITTINGS • CABLE TERMINATORS • SOLDERLESS CONNECTORS • POWER CONNECTORS • GROUNDING DEVICES.**

Designers and engineers who are planning post-war building or re-conversion can enjoy the purchasing advantage of using O. Z. as a single high-quality source of supply. Write, on your business letterhead for your free copy.

5673

O.Z. ELECTRICAL MFG. CO.

262 BOND STREET BROOKLYN, 2 N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

ment for all P&H products. During this time, he also headed design and development control for overhead traveling cranes and hoists. Mr. Blum is well known to overhead crane users for his frequent contributions to industrial magazines on efficient crane operation and maintenance. Prior to joining Harnischfeger, he was associated with Cutler-Hammer for seven years.

▶ H. J. SCAIFE, Hotpoint factory branch manager at Buffalo, N. Y., has been named manager, kitchen sales division of Edison General Electric Appliance Co., Inc. Mr. Scaife returns to Chicago after two years at the Buffalo branch. He joined Hotpoint at Chicago in 1936 as assistant refrigeration sales manager. In 1938, Mr. Scaife went to Honolulu, Hawaii, as Hotpoint's sales representative, returning before Pearl Harbor day.

▶ ROBERT S. DURLING, until recently purchasing director of Monitor Controller Co., Baltimore, Md., has been appointed director of industrial relations. ROBERT JORDAN has been named to succeed Mr. Durling as purchasing director. Mr. Jordan previously directed his attention to priorities work for the company.

▶ MARGURETTE REINHART of Boise, Idaho, has been appointed director of the laboratory of modern living recently organized by Landers, Frary & Clark, New Britain, Conn. Miss Reinhart was the winner of the 1942 Laura McCall Award for her outstanding contribution to the advancement of electrical living while home service director of the Idaho Power Co. She was graduated from the University of Idaho in 1937 and after a year in the home service department of the Idaho Power Co. she was advanced to director of home service, the position she held for three years. As director of the Universal laboratory for modern living, Miss Reinhart will work closely with the engineering, promotion and sales departments in connection with the development of electrical appliances for the home as well as other Universal household specialties.

OBITUARY

▶ WILLIAM H. NEWBOLD, assistant director of research for the Philco Corp. who was in charge of the development of war projects, died in Philadelphia on April 28 at the age of 39. Mr. Newbold who was graduated from the Pennsylvania State College, joined the Philco research staff in 1933 and was made assistant director of research in 1941. Mr. Newbold was a member of the Institute of Radio Engineers and the Franklin Institute.

HOW MUCH LESS PAPER CAN YOU USE IN YOUR PLANT?

That's a mighty important question. Paper stocks are seriously low this year, and every time another shipload of paper-wrapped war supplies leaves an American port, the problem gets tougher • The voluntary cuts, the simple economies you have put into operation up to now, won't be half enough in 1944 • The only answer is honest, convincing *paper-pinching* by every one who uses paper • Organize a Paper Conservation Committee in your company. Pick only the best men for this job, and give them a green light so that they can work effectively • From envelopes to heavy cartons, have this Committee see to it that functional packaging is the order of the day—every day • In the panel are suggested many ways your plant can use less paper. But you know your own business best! Go to it *NOW!*

Use Less Paper Because

Multiwall paper bags are used extensively in shipping flour and dehydrated foods.

All openings and exposed surfaces of tanks are sealed with paper for shipping.

Submachine guns are not only paper-wrapped but boxed in paper board. Shell grommets, bomb rings and practice bomb fins are made of paper to save needed steel.

Gas-mask canisters and hand-grenade containers are made of paper.

Paper is used in camouflage strips and netting and parachutes.

All Army clothing and equipment are shipped in waterproof paper wrappers.

Use Less Paper These Ways

Condense letters and memoranda by (a) keeping margins as narrow as possible; (b) sticking to single-space forms; (c) using reverse side of incoming letters as first carbon copy of replies; (d) using reverse side of second sheets for carbon copies; (e) using both sides of all mimeographed sheets.

Check carefully to determine whether your shipping container exceeds the requirements of Rule 41 of "consolidated freight classification requirements."

Eliminate individual cartons in every practical instance.

When individual cartons are indispensable, pack in bulk whenever possible.

Control disbursement of paper supplies to employees so that excessive quantities do not accumulate in desks and departmental supply closets.

This advertisement prepared under the auspices of the War Advertising Council in co-operation with the Office of War Information and the War Production Board.

LET'S ALL USE LESS PAPER

Space for this advertisement contributed by ELECTRICAL WORLD

MANUFACTURING-MARKETS

A-C Reports Net Up; Orders Drop in '44

For the first quarter of 1944, the Allis-Chalmers Manufacturing Co., Milwaukee, Wis., reports a net income of $1,789,693 or $1.00 a share on 1,776,092 shares of outstanding common stock. This is after provision of $7,500,000 for estimated federal income and excess profit taxes. The net income for the first quarter of 1943 was $1,432,138, or eighty cents a share.

In the first quarter of 1944 billings amounted to $79,004,045 and orders booked totaled $46,912,552, in comparison with billings of $46,475,895 and orders booked of $59,748,075 in the comparable quarter of 1943.

Unfilled orders on March 31, 1944, totaled $303,835,151 as compared with $183,705,029 on March 31, 1943.

•

Aircraft Electrical Council Formed

To provide manufacturers of electrical equipment for use in aircraft with reliable information regarding specific performance and design requirements, and to establish a more effective contact between the two industries, the Aircraft Electrical Council, a subdivision of the National Electrical Manufacturers Association, has been formed.

The Council, already composed of approximately fifty NEMA member companies whose equipment finds use in aircraft, will contribute in every way possible to the quick transfer of information between the electrical and the aircraft manufacturing industries. At the same time, the Council will make available to producers of aircraft, and to those representatives of the Armed Services interested in aviation problems, the experience and facilities of electrical manufacturers. The entire aircraft industry and its affiliated professional and technical organizations are being cordially invited to consult with the Aircraft Electrical Council on any problems pertaining to the development and procurement of pertinent electrical equipment.

Formal organization of the council took place recently in Chicago in conjunction with the NEMA spring meeting, with N. J. MacDonald as organizing committee chairman. The council maintains its offices at the NEMA headquarters, 155 East 44th St., New York.

•

Electrical Union to Appeal to WLB

Acting in behalf of 225,000 members in 46 cities, the United Electrical, Radio and Machine Workers of America, an affiliate of the Congress of Industrial Organizatons, announced recently that the union would submit its demand for a general increase of 17 cents an hour to the War Labor Board. The wage rise has been in negotiaton with the General Electric Co. and the Westinghouse Electric & Manufacturing Co. for several months.

The union's decision to take the issue before the WLB was reached at a conference of union delegates from all affiliated locals last week. This conference "severely criticized the wage freeze in existence since the Stabilization Act of October, 1942, and the absence of any effective price control, and characterized the tax bill recently enacted by Congress as provocative and demoralizing."

•

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

A. L. Smith Iron Co., Chelsea, Mass., has appointed J. H. Brundage as Metropolitan District manager of their New York office. Mr. Brundage has been associated with the lighting industry for many years, three of which were with General Electric lamp division in Chicago, two with the General Electric Supply Corp. in Cleveland and for the past eight years he has been in the capacity of district lighting specialist in charge of lighting equipment sales for the General Electric Supply Corp. in New York City. The New York office will control sales in Metropolitan New York, lower New York State, Long Island, State of Connecticut and Springfield, Mass.

Electrical Engineers Equipment Co., Melrose Park, Ill., has appointed Norman F. Harrington, 48 Lincoln Road, Snyder, Buffalo 21, N. Y., as district representative in Buffalo.

Electromaster, Inc., has announced the appointment of Pierre L. Miles Co. of Chicago as Mid-West sales representative for Electromaster domestic ranges and water heaters. The territory will include Chicago and northern Illinois, Indiana, Wisconsin

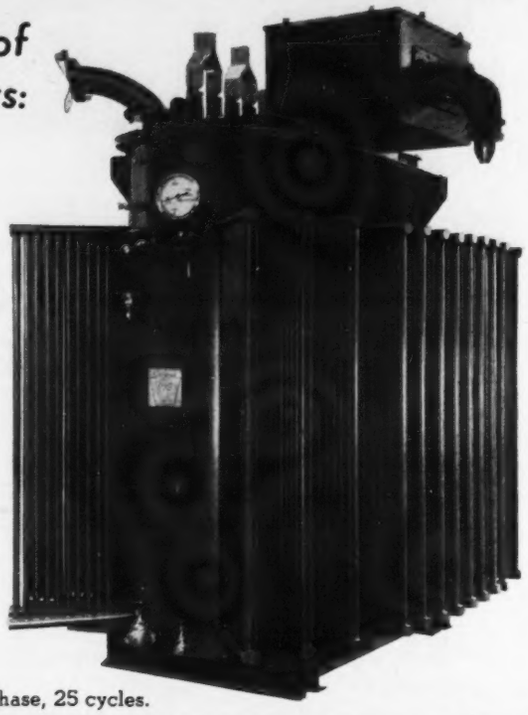
START OF A JOURNEY—What General Electric says is the largest single shipment of transformers ever to leave the Pittsfield, Mass., Works, got under way recently for an unrevealed destination. A 16-car freight train hauled these units from the plant, nine of the cars being of the drop-frame type to meet railway clearances. Seven of the transformers are 10,000-kva units and seven others about half that rating. They are of the 15-kv. class, self-cooled, oil-insulated, for 3-phase service, and were built with special material on a rush order requiring completely new engineering and drafting

For convenience and economy of transformer installations indoors near the load centers

Ask for Askarel

Pennsylvania's noninflammable, non-explosive, liquid-filled transformer

Check these outstanding qualities of Pennsylvania Askarel Transformers:



3000 kva, ASKAREL, 3 phase, 25 cycles.

Circular Coils Possess Maximum Inherent Strength

In regular oil-cooled transformers, varnish is used to increase the mechanical and electrical strength of the transformer coils, irrespective of the shape of the coils. This kind of varnish, however, cannot be used to treat coils in a transformer where noninflammable liquids are employed. Therefore, without the aid of this varnish, it is imperative that the coils in a noninflammable transformer have great inherent strength. Pennsylvania circular coils possess the maximum inherent mechanical and electrical strength!

Radiators Built to Withstand High Pressures

Askarel transformers develop high pressures inside the tank because of the sealed, pressure-tight, tank construction necessary to prevent loss of Askarel through evaporation. Sturdy Uni-Row radiators on Pennsylvania Askarel transformers are designed to meet these high pressures. As rugged as the tanks themselves, these radiators are premanently welded in position and tested at 100 lbs. pressure. Radiators are spaced around the tanks so that each tube of each radiator is easily sandblasted, cleaned and painted.

Self-Reclosing Safety Valve Relieves Excessive Pressures.

Safety valves are mounted on the covers of all Askarel transformers above 25 kva, and operate in case abnormal pressures exceeding 12 pounds per square inch develop inside the tanks. These safety valves are self-reclosing to prevent foreign matter from entering the transformers.

333 kva, ASKAREL, 1 phase, 60 cycles.

25 kva, ASKAREL, 1 phase, 60 cycles.

Pennsylvania TRANSFORMER COMPANY
PITTSBURGH PENNSYLVANIA

Pennsylvania TRANSFORMERS

- Since Askarel Transformers are noninflammable and nonexplosive, they may be installed indoors at the load centers without a vault or fire door.
- Since Askarel is nonsludging and nonoxidizing, and the transformer tanks are pressure-tight and moisture-proof, Askarel transformers may be installed outdoors as well as indoors.

Ingenious New Technical Methods

Presented in the hope that they will prove interesting and useful to you.

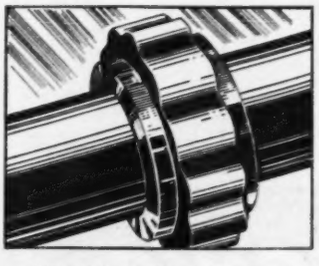
Precision Ground Glass Gages Afford Visibility in Inspection

In the hands of the skilled mechanic, glass gages bring an important plus function to precision gages. It not only checks the new tool's size, but gives the inspector an idea of what kind of surface to expect from that particular tool. The visibility permitted by the glass gage allows the inspector to see the surface in blind holes as well as through holes.

Some of the apparent advantages of the glass gage follow: Glass gages afford visibility in inspection. Glass gages are not subject to corrosion. There is less tendency to gall in some applications. Sense of feel is more pronounced when using glass gages. Because the thermal conductivity of glass is less than steel, body heat of inspectors will not be transmitted so rapidly to the gage to affect gaging dimensions.

Chewing gum, too, is really useful and helpful in these tense times to people who are working on the production front making material for our war effort. But, our Armed Forces have been constantly increasing their demands for Wrigley's Spearmint, Doublemint and Juicy Fruit. It is only natural that we and you both feel that the needs of our fighting men and women come first.

Glass gages are not subject to corrosion or rust.



Visual inspection of surface coincident with inspection for size.

You can get complete information from Industrial Glassware Division of the T. C. Wheaton Co., Millville, N. J.

Y-115

and Minnesota. Mr. Miles brings to Electro master a broad background of experience in the electrical appliance industry. He was with Hotpoint for 22 years and, more recently, was sales manager for Nash-Kelvinator.

•

Copies of NEC Spanish Edition Are Ready

Copies of "Codigo Electrico Nacional E.U.A.," the translation of the National Electrical Code into Spanish, are now available for distribution. This undertaking was a co-operative enterprise by a group of members of the National Electrical Manufacturers Association and was carried out under the direction of the NEMA committee on promotion of the National Electrical Code in South America, of which John W. White, president, Westinghouse Electric International Co., is chairman.

The translation and printing was carried out by the Business Publishers International Corp., an affiliate of the McGraw-Hill Publishing Co., New York. Copies of the Spanish edition of the code have already been distributed to all those who placed advance orders. Others interested may obtain copies from NEMA Industry Service Department.

•

Champion Lamp Expands

Champion Lamp Works of Lynn, Mass., Division of the Consolidated Electric Lamp Co., moved its New York offices on May 1 from 152 W. 42 Street to the Graybar Building. The personnel as well as the space and facilities of Champion's New York office is being increased in anticipation of increased post-war demand for Champion fluorescent and incandescent lamps.

•

New Bendix Bulletin

Bendix Home Laundry Institute has issued the first copy of "Through The Porthole", a new bulletin service which will be published once a month. The object of this bulletin is to give a monthly report on new ideas in demonstrating laundry equipment in the home and from the platform.

•

New New York Office

Allen-Bradley Co. of Milwaukee, Wis., has announced the removal of their New York offices to 155 East 44th St., New York, 17, N. Y. C. N. Calkins remains in charge as New York district manager.

Field Reports on Business

Though Government orders for electrical material, generally speaking, have dropped in number, the huge amount of naval construction requires considerable electrical supplies. Small motors and switch and control apparatus are strong. Retail sales remain brisk.

NEW ENGLAND

Boston Edison is planning to build a 28-mile, 110-kv. transmission line between Framingham and Woburn, Mass., to meet increasing demands for service in the western suburban areas adjacent to Boston. Switch and control apparatus is strong, and small motors are moving steadily again after some slowing down earlier in the season. Gamewell Co., Newton Upper Falls, Mass., has been awarded contracts for installing several fire alarm systems at housing projects under the direction of the FHA, located in Connecticut and Massachusetts, and Coken Co., Providence, R. I., had contracted to install pumping units and street lighting in various FHA projects.

Sylvania Electric Products Inc., will soon begin production of lamp fixtures and special lighting units used by the armed forces at its Lowell (Mass.) plant where 200 to 300 will be employed. Numerous contracts for small storage plants and additions to housing facilities at naval stations in this district have been awarded by the Bureau of Yards & Docks, among which are noted a $32,987 addition to storage facilities at a depot, addition of another airfield taxiway which will require lighting supplies, costing $47,723, and small contracts ranging from $10,000 to $20,000 estimated cost. Bids were submitted last week by Connecticut manufacturers for more than $50,000 worth of electric soldering irons, and Massachusetts manufacturers bid on electric portable drills, low velocity electric blowers, distribution transformers, and wiring supplies.

Electrical contractors in the greater Boston area are busy with changes and additions to power equipment in small factories; lighting installations are in good number.

CHICAGO

The manpower picture in this area is not getting any brighter. Last week it was announced by the local WMC office that 90,000 additional workers in war industries are needed in the Chicago area between now and Sept 1 to meet production schedules. It was indicated that only 54,000 will be available. Demands for men are greatest in the iron and steel, non-ferrous metals and meat packing and transportation industries where women cannot be used. Demands for women are greatest in the transportation equipment and in the electrical and non-electrical equipment industries.

Long delayed completion of Chicago's 79th St. water filtration plant is now sure of completion. The Federal government has granted the necessary equipment priorities and work will move along speedily as soon as shipments can be made. The city is planning post-war public improvements valued at 1¼ million dollars. They include water improvements, aviation and recreation facilities, new parks, additions to the subway and superhighway system, schools, new sewage disposal plants and a central railroad terminal. If conducted simultaneously they would take six years to complete.

Among recently listed war orders received by electrical manufacturers in Chicago are an order for fuse and disconnecting fuse units in the amount of $1,157 awarded to Schweitzer and Conrad for the Bonneville Power Administration; also one from the U. S. Coast Guard for an automatic voltage regulator in the amount of $1,161, awarded to Sola Electric Co. here.

NEW YORK

Business conditions, generally, are being dominated at present by the military situation. Though the trend of industrial production as a whole is slightly downward, reports from the heavy industries during the past week were favorable.

Civil engineering construction volume in the continental U. S. totaled $41,856,000 last week. This volume is 57 percent higher than in the preceding week, and 18 percent higher than the weekly average for 1944 to date, but is 42 percent lower than the total reported to *Engineering News-Record* for the corresponding 1943 week. Private construction was 65 and 159 percent higher, respectively, than for a week ago and a year ago. Public construction topped the preceding week by 53 percent, but was 58 percent under the week last year. The week's volume brought 1944 construction to $637,018,000 for the 18-week period, a decrease of 51 percent from the $1,290,346,000 reported in 1943.

Favored by fine weather, department store sales in the metropolitan district were estimated at about 10 percent ahead of the similar week last year.

PACIFIC COAST

Government bids covering electrical material have perhaps temporarily dropped in number and quantities specified so that May so far has not maintained the increasing momentum of 1944. However, most wholesalers report good backlogs of orders and although Army construction and perhaps housing is about completed, there is a huge amount of Naval construction in all three stages of appropriation bidding and award.

The most recent appropriation of all, $1,644,373,000 for naval shore facilities in overseas bases and along our coastlines, is largely earmarked for the Pacific area. A $6,695,200 appropriation has been requested for 1944 work on Shasta and Friant dams and power plants and $25,000,000 for 1945 construction of Keswick Dam and lines.

Congress has been asked to lift present restrictions limiting use of Central Valley irrigation water to 160 acre farms and under a 24-mile 88.000-volt transmission line of 250,000 cm. cable and wooden poles will be built in Imperial Valley area, linking El Centro with No. 4 plant.

An allotment of $1,437,000 has been made for Adams Tunnel under Rockies for Colorado Big Thompson project. Prospective electrical orders from railroads include $49,500 floodlights for Salt Lake City and Minturn yards of D. & R. G. and the Union Pacific's $883,046 central traffic control system in Utah. DFC has granted necessary priorities for necessary substation and wiring for Monolith Portland Midwest Co.'s alumina plant at Laramie, Wyo.

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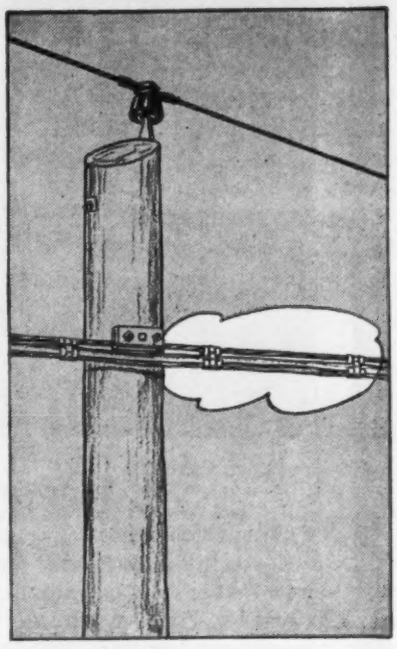
Reduce Maintenance



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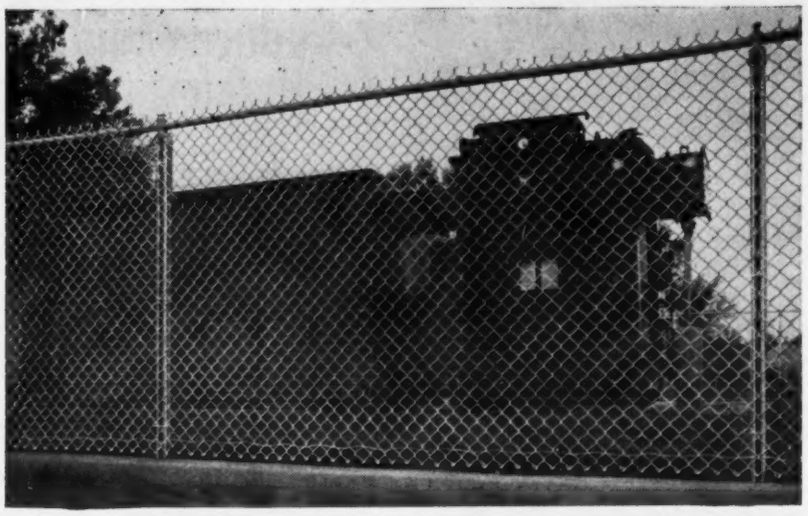

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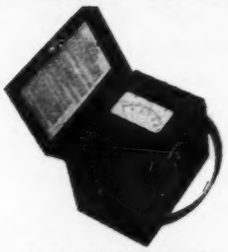

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Sales Opportunities

NORTH DAKOTA—Dakota Public Service Co., Bismarck, plans extensions in 38,000-volt transmission line. Project will include power supply for service at mining properties of Truax-Traer Coal Co., where power substation will be located for distribution. State permission has been secured and work will be carried out soon.

WASHINGTON—Bureau of Yards and Docks, Navy Department, Washington, D. C., has plans for expansion in power facilities at Puget Sound navy yard, including extensions in power substations with transmission and distribution lines, service connections and miscellaneous work. Cost about $875,000, of which $400,000 will be used for line construction including extensions outside immediate yard area. Public Works Officer at yard will be in charge.

MICHIGAN—Campbell, Wyant & Cannon Foundry Co., Muskegon, manufacturer of iron and steel castings, will make further extensions in plant for production for government, with mechanical and electrical equipment. Cost about $665,000, with financing by Defense Plant Corp. This supplements a fund of $1,400,000 recently secured through same source for similar plant development.

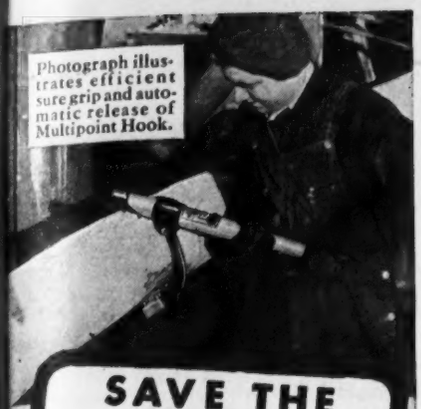
FLORIDA—Navy Department, Washington, D. C., has approved plans for power plant at naval auxiliary air station, and will begin work at once. Cost reported over $175,000, with equipment. Bureau of Yards and Docks, Navy Department, Washington, D. C., will be in charge.

CALIFORNIA—Henry J. Kaiser Co., Inc., Latham Square Bldg., Oakland, plans new shell-forging and machining plant at iron and steel division works, comprising several one and multi-story buildings, with machinery and electrical equipment for large output. Cost reported close to $7,500,000. Power plant now in service for iron and steel mills will be increased. Motor-generator sets, switchgear and other facilities will be installed for power supply for new plant structures, which will be used to handle an artillery projectile contract for War Department, Washington, D. C., totaling about $25,000,000.

VIRGINIA—Bureau of Yards and Docks, Navy Department, Washington, D. C., plans reconstruction of electric feeder system at naval torpedo station, including underground conduit lines and other facilities. Cost about $90,000. This is part of a general improvement program to be carried out at plant, including extensions in several buildings with mechanical and electrical facilities, and other work, totaling about $300,000.

NEW YORK—General Motors Corp., General Motors Bldg., Detroit, Mich., will carry out expansion in Brown-Lipe-Chapin Division plant, for production for government, with installation of machinery and electrical equipment. Cost about $1,000,000, with financing by Defense Plant Corp.

VIRGINIA—Water Department, Williamsburg, plans installation of motor-driven pumping machinery, with controls and auxiliary equipment in new raw water pumping station. Fund of about $275,000 has been arranged for plant and extension



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and improvements in water system. Financing has been approved through federal aid. Wylie & Wilson, Peoples' National Bank Bldg., Lynchburg, are consulting engineers.

SOUTH DAKOTA—Common Council, New Effington, plans installation of an ornamental street-lighting system in downtown district as a post-war project. Estimates of cost will be made soon. Leo Griep, mayor, is at head of project.

IOWA — Spencer Municipal Utilities, Spencer, R. M. Tuttle, chairman, will receive bids until June 8, for new boiler unit for municipal power plant, with rated minimum capacity of 30,000 lb. of steam per hour. Also for stoker and auxiliary equipment.

MICHIGAN—Wilson Foundry & Machine Co., Pontiac, manufacturer of iron castings, etc., will carry out expansion in plant for production for government, with installation of machinery and electrical equipment. Cost about $380,000, with financing by Defense Plant Corp. Work is scheduled to proceed at early date.

NEW HAMPSHIRE—Bureau of Yards and Docks, Navy Department, Washington, D. C., has authorized expansion in power facilities at navy yard, including extensions in power substations, transmission and distributing lines, service connections, etc., estimated to cost about $600,000. Approximately one-half this sum will be used for line construction, including system extensions outside immediate yard area. Public Works Office at yard will be in charge.

WASHINGTON — Kitsap County Public Utility District No. 1, Port Orchard, plans new primary and secondary lines, including service connections and other operating facilities. Application for permission has been made to Board of County Commissioners, and work is scheduled to begin as soon as authorization has been secured.

INDIANA—Navy Department, Washington, D. C., has plans for expansion in naval ammunition depot, including addition to industrial shop to cost about $225,000, with mechanical and electrical equipment; also extension in pyrotechnic plant to cost $350,000, material storage plant, $125,000 and other structures. A new steam-generating station is planned to cost $225,000, and pumping station, $45,000. Extensions will be made in power substation facilities, distribution system, service connections, etc. Entire project is estimated to cost about $7,965,000, and will be carried out under direction of Public Works Officer at depot.

NEW HAMPSHIRE—Brown Co., Berlin, plans extension in pulp and paper mill, including rebuilding and modernization of part of plant, with installation of considerable machinery and electrical equipment. A new paper-making machine and auxiliary equipment will be installed at later date. Entire project is estimated to cost about $6,500,000, and will be carried out, it is understood, as a post-war development, or as soon as materials and equipment are available.

NEBRASKA—Polk County Rural Public Power District, Stromsburg, plans extensions in primary and secondary lines, with line transformers, service connections and other operating facilities. Permission has been secured from State Commission and work is scheduled to begin soon.

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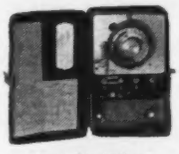
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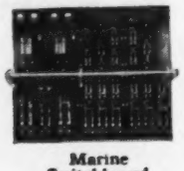
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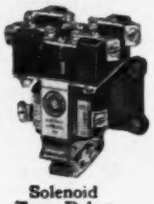
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New Funds Allotted for Rural Projects

The Rural Electrification Administration recently announced allotments totaling $1,245,000 to 26 rural electric systems in 14 states. All funds will be used to extend electric service to nearby farms which have qualified under War Production Board regulations permitting connections for increasing food production. No construction will be undertaken which does not have such approval.

These allotments, which bring total REA allotments to $485,690,051, of which $19,727,138 represents operations during the current fiscal year, include the following:

ILLINOIS—McDonough Power Co-operative, Macomb, $50,000.

INDIANA—Marshall County REMC, Plymouth, $30,000; Decatur County REMC, Greensburg, $20,000; Hendricks County REMC, Danville, $25,000.

IOWA—Glidden Rural Electric Co-operative, Glidden, $65,000; Farmers' Electric Co-operative, Inc., Greenfield, $75,000; Allamakee-Clayton Electric Co-operative, Inc., Postville, $65,000.

LOUISIANA—South Louisiana Electric Co-operative Assn., Houma, $50,000.

MICHIGAN—Presque Isle County Electric Co-op. Assn., Onaway, $40,000; Fruit Belt Electric Co-operative, Cassopolis, $60,000.

MISSISSIPPI—Coast Electric Power Assn., Bay Saint Louis, $50,000; Pearl River Valley Electric Power Assn., Columbia, $60,000.

MISSOURI—Lewis County Rural Electric Co-op. Assn., Monticello, $150,000; Barton County Electric Co-op., Lamar, $20,000.

NEBRASKA—Butler County Rural Public Power District, David City, $50,000; Southern Nebraska Rural Public Power District, Grand Island, $40,000.

OKLAHOMA—Southeastern Electric Co-operative, Durant, $50,000.

SOUTH CAROLINA—Newberry Electric Co-operative, Inc., Newberry, $25,000; Berkeley Electric Co-operative, Inc., Moncks Corner, $40,000.

TEXAS—South Plains Electric Co-operative, Inc., Lubbock, $40,000; Hamilton County Electric Co-op. Assn., Hamilton, $60,000; Karnes Electric Co-operative, Inc., Karnes City, $40,000; Jasper-Newton Electric Co-op., Inc., Kirbyville, $50,000.

VIRGINIA—Craig-Botetourt Electric Co-op. New Castle, $15,000.

WASHINGTON—Stevens County Electric Co-op., Inc., Colville, $35,000.

WISCONSIN—Jackson Electric Co-operative, Black River Falls, $40,000.

•

Fort Peck—Utility Line

Construction of a 140-mile power line to transmit electricity from Fort Peck, Mont., to a point on the system of the Montana-Dakota Utilities at Glendive has been approved by the War Production Board, it was announced recently. The line would conserve natural gas by replacing gas steam-generated power with hydrogeneration to supply low cost power for irrigation pumping.

Our subscription waiting line

May we have your help? Please don't wait until the last minute to renew your subscription to Electrical World because you might forget and then the best we could do would be to put your name on the waiting list of around a thousand and it might take three months or more before your name would come up.

And that isn't all. Even when your name does come up we shall not be able to supply the missed copies to fill out your file. We have no more extra copies.

This is an unusual situation for a publisher to face but the fact is that paper is extremely short due both to an increased demand for packaging of war materials for shipment overseas and to a shortage of labor in the woods. Supply of wood products of which paper is one of the most important is in the same critical position that copper products were in a year ago.

Like all other publications, we are operating under a fixed allotment of paper, having had two cuts. We did not cut the editorial content nor reduce the number of subscribers. What we did was to freeze our circulation at the current figure and then, as waiting lines of new subscribers began to grow, we adopted the policy of cutting off subscriptions promptly on expiration—not, however, without giving each subscriber at least four notices of expiration in time for him to send in his renewal.

We would much rather serve an old subscriber than a new one if it were a matter of choice. We don't, however, feel that a new subscriber should be denied copies while we are waiting for someone to make up his mind.

We will do everything within our power to serve you without a break if you will help us. Please answer renewal notices promptly.

Electrical World

330 W. 42nd STREET, NEW YORK, N. Y.

Recent Rate Rulings

PUBLIC SERVICE CO. OF COLORADO and the City of Denver reached an agreement recently after months of negotiation when a reduction was announced affecting small commercial customers to the amount of approximately $260,000 annually. A further result of parleys between Mayor Ben F. Stapleton, City Council and John E. Loiseau, president of Public Service Co., will be an arbitrary reduction of $12,500 per month in the city's street lighting bills for one year, a total of $150,000. Benefits to the small commercial users of power will be derived from a change from the old demand form (involving the "readiness to serve" factor based on connected load, plus energy actually consumed) to a new block system, recently perfected, which will charge the consumer for only the kilowatts metered. Between 10,000 and 11,000 concerns in Denver are affected. The change —which still must be formally ratified by the Denver City Council, whose consent is taken for granted since its members had a hand in developing the new formula—does not apply to domestic customers, large industrial or commercial firms. The company's agreement to pay $150,000 into the city's lighting fund was modified by President Loiseau's expressed hope that the amount will be dedicated to completion of Denver's street lighting program, interrupted by war shortages of material. May bills will reflect the first reductions in rates.

PORTLAND GENERAL ELECTRIC CO.'s rates in seven Oregon counties, characterized as "unjust and discriminatory, enabling the company to obtain greater revenue than is actually required to provide a reasonable return on its invested capital," will be aired at a hearing scheduled to begin May 15 before Public Utilities Commissioner George H. Flagg. The hearing will be held in Portland and it is expected that appearance at the hearing will be entered by the independent trustees of the Portland Electric Power Co., parent company of PGE, and other intervenors. Commissioner Flagg and officials of PGE were reported near an agreement on a reduced rate schedule, several months ago, but their tentative plans were blocked by refusal of the independent trustees to agree to a settlement of any character. As a result, Commissioner Flagg issued an emergency order last December 13 reducing rates in the seven counties which had entered protests. The order was attacked by the company. The Marion County circuit court having sustained the commissioner's order, an appeal is now pending before the state supreme court, which granted a temporary injunction restraining the commissioner and recently added 90 days to its injunction against enforcement of the state public utilities commissioner's emergency order. Simultaneously, the court extended by 90 days the time of the emergency rate order, originally set for 120 days, expiring April 23.

NEW YORK STATE ELECTRIC & GAS CORP. rate charges for electricity supplied to the United States Naval Training Station at Sampson will be investigated by the state Public Service Commission. The probe was instituted on complaint of the Commandant of the Naval Station that the rates were too high. The matter was brought to the attention of the commission some months ago by representatives of the station Commandant. It appeared that service was furnished under a contract expiring June 30, 1944. In view of this agreement, the commission had no jurisdiction while the contract is in force. Navy officials at the base tried to renegotiate for better terms

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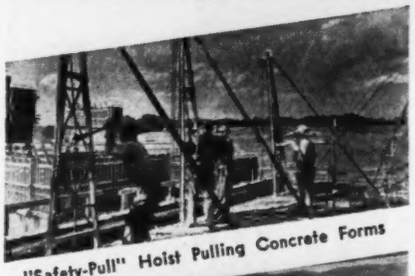

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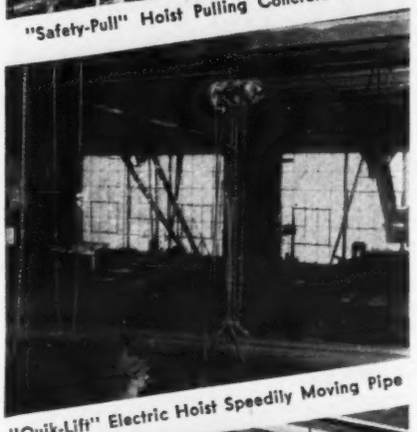

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and having failed, have asked the commission to intervene, stating that they are desirous to reach an early agreement for 1945 at rates less costly to the navy. The commission, therefore decided that as the existing contract is to expire shortly, the investigation should not be delayed.

* * *

PACIFIC POWER & LIGHT CO.'s electric customers in Oregon and Washington will receive a "rate dividend" this month amounting to $300,000. George H. Flagg, Oregon public utilities commissioner, and Charles F. Schaefer, Washington Department of Public Service, announced that the dividend would be distributed owing to abnormal earnings attributed to war demands. While the rate dividend has been used elsewhere, this is its first application in the Pacific Northwest. It is designed to give customers the benefit of increased, abnormal business without upsetting the regular rate structures. Each customer will receive a check for approximately one-half of his average monthly bill, including all classes of users.

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Surveys Industrial Electrical Needs

War production and related activities will increase the industrial use of electric energy for all manufacturing and extracting industries for the five-year period, 1939 through 1944, by 116 percent or from 79 billion kilowatt-hours in 1939 to 170 billion kilowatt-hours estimated for 1944, the Federal Power Commission has announced in a report recently issued entitled "Electric Power Requirements of Industrial Establishments in the United States." The report presents data on the industrial use of electricity in the United States for the period 1939-42, inclusive, and the estimated use for the years 1943 and 1944.

	Millions of Kilowatt-Hours		
	Actual Use	Estimated Use	% of
Industry Group	1939	1944	Increase
Chemicals	9,811	32,636	233
Nonferrous Metals	5,956	28,560	380
Iron & Steel	12,235	24,329	99
Paper	9,394	11,941	27
Textile	6,805	9,977	47
Food	6,388	8,386	31
Transport. Equip.	482	7,635	1,484
Stone, Clay & Glass	4,852	6,437	33
Petroleum & Coal	3,440	6,296	83
Machinery, except Electrical	1,985	6,254	215
Automobiles	2,467	4,668	89
Electrical Machinery	1,432	3,895	172
Rubber	1,584	2,075	31
Lumber	1,238	1,668	35
Miscellaneous	466	1,005	116
Printing	859	989	15
Furniture	605	904	49
Leather	402	531	32
Apparel	353	454	29
Tobacco	115	153	33
All Manufacturing	70,869	158,793	124
Extracting Industries:			
Coal Mining	3,523	5,408	54
Metal Mining	2,912	4,380	50
Nonmetallic Mining	813	1,291	59
Petroleum & Natural Gas	837	938	12
All Extracting	8,085	12,017	49
All Industries*	78,954	170,810	116

* Excludes government owned and operated establishments.

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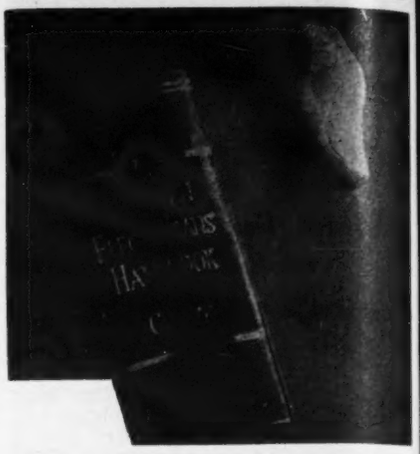

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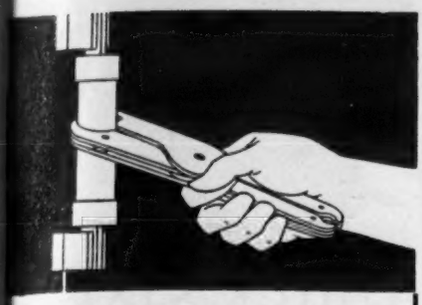

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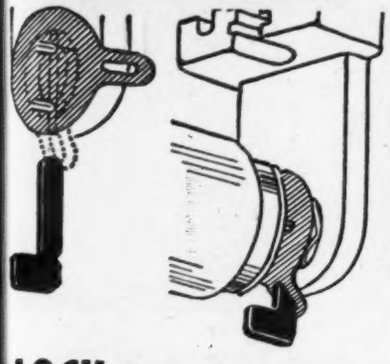

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Utility Reports Rural Progress

An increase in both rural customers and total mileage of rural electric lines was experienced in 1943 by the Public Service Co. of Northern Illinois. During the year, 509 new customers were added to the company's rural lines and total length of power lines was increased from 6,164 miles to 6,212, Britton I. Budd, president, disclosed recently in a statement on company rural service activities.

Today, Mr. Budd pointed out, the company furnishes electric service to 24,395 farms and rural units across a 16-county area in which over 85 percent of the farms now have electricity available.

Average kilowatt-hour use per farm customer for 1943 was 2,228 compared with 2,017 in the previous year—an increase in average use of 211 kw.-hr. it was pointed out. In December the average farm customer used 199.6 kilowatt-hours as compared with 187.6 in the same 1942 month.

The company has plans available and is urging its farm customers to build homemade pig and chicken brooders, milk stirrers, and other electric devices which require few critical materials and will augment the dwindling supply of manufactured electric equipment during the 1944 farming season.

•

Sees British Small Home As Promising Market

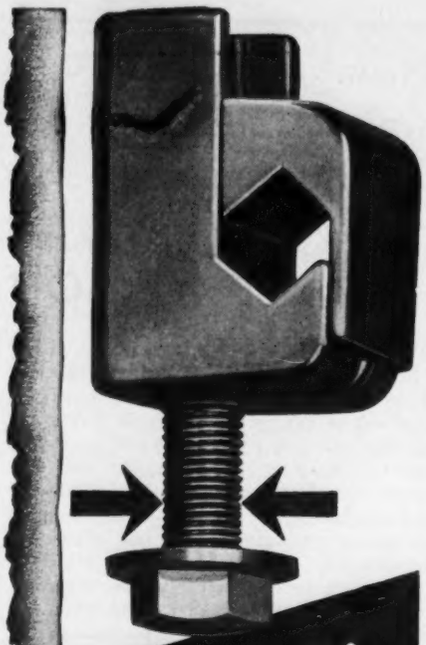
Statistics indicate, according to *Electrical Review*, that there are 2,700,000 unwired homes in Great Britain, excluding Northern Ireland, "the majority of which can be assumed to be of the lower middle class type of property."

The situation is as follows:

Total no. of homes....	11,200,000
Unwired	2,700,000

It appears from the above that the electrical "supplies" manufacturers' most promising and immediate future lies in that market serving the smaller homes considering electrification.

Another promising market is the anticipated marine and export business. The high standard of the marine product is understood by the British manufacturer. The export business, whether with the empire or foreign countries, is more complicated, due to severe competition to be encountered and to the fact that British electrical standards are not acceptable in many countries. To quote the *British Electrical Review*, "British manufacturers will of necessity have to give more consideration to the



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requirements of likely export markets. The "take it or leave it" policy will not capture export markets. Requirements will have to be studied by personal contact with the countries concerned, and when suitable products are available they must be extensively and persistently advertised on the lines practised in that home market.

•

Will Broaden Sales Program After War

After the war Commonwealth Edison Co. will not only resume appliance merchandising activity but will expand it to meet the demands for appliances that have not been available during the war, Vice-president William T. Reace told the Womens' Information Committee in Chicago recently in outlining Edison post-war sales plans.

The company will continue to display and sell a complete line of electrical merchandise in its central and neighborhood stores, Mr. Reace stated. Additional branch offices will be established, he indicated.

Extended co-operation with dealers, to help them to do a better job of merchandising, will include advertising, demonstrations, prize contests and training of personnel. Field sales will be resumed with special crews devoted to campaigns in which they will not compete directly with community store activities. Salaried district representatives will replace house-to-house specialists and straight commission salesmen.

Emphasis will be placed on those appliances that have the greatest load-building possibilities, such as ranges, water heater and air conditioning equipment, Mr. Reace stated.

The extended sales program of the company will require a considerable expansion of the company sales force—an expansion that can readily absorb many of our men as they return from the armed forces, it was said.

•

Starts New Substation

Foundations are being poured for Danville's new $35,000 electric substation through which the city will be able to tie in with the Appalachian Electric Power system. Under an agreement already signed, Danville, in times of water shortage or breakdown, would cut in on the Appalachian system. The city also would turn surplus power into the Appalachian system. The city is planning to tear down the old steam plant when the new substation is completed by the end of June.

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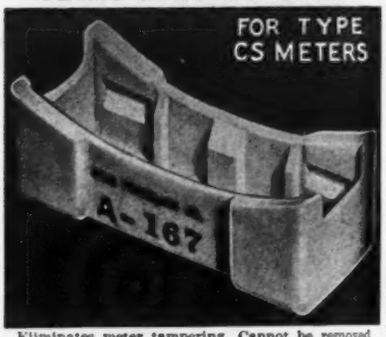

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BOOKS RECEIVED

Industrial Electronic Control. By W. D. Cockrell. McGraw-Hill Book Co., New York, N. Y. 247 pages, illustrated. Price $2.50.

War has accelerated adoption of electronic controls in industry at a rate which has afforded few industrial engineers the opportunity to learn about the functions of the tubes and the auxiliary elements. Nor may they have too much confidence in the radio servicemen who are practically the only ones available to shoot trouble in industrial electronic controls. This book is for both these groups; it contains neither tube theory nor application technique but, on the other hand, focuses on the functions performed by each of the component parts of typical controls of numerous objectives and origin. A particularly significant feature is the arrangement of the diagrams so that those familiar with non-electronic types of controls can see the functional parallels with the electronic types. Appendices offer RLC alignment charts and rectifier wave shapes.

Price Making in A Democracy, by Edwin G. Nourse. The Brookings Institution, Washington, D. C. 541 pages, price $3.50.

Prices tell when business and its direction are bad or good. But can business be kept good by good priee management without preemption of private-business prerogatives by NRA, OPA or what? "Brookings" says the avoidance will come only if American business dedicates maximum material satisfaction to its consumers. Their book presses the analysis of the trend toward relinquishing some freedom to achieve some control, believing that business can self-regulate its price-making but asserting that the effort will require economic statesmanship.

Utility rate-makers will find of real interest the discussion of elasticity of demand. "Sound price lowering is functionally related to both decline in technical costs and responsiveness of sales to price reductions."

TVA-Democracy on the March. By David E. Lilienthal. Published by Harper & Bros., 49 E. 33rd St., New York, N. Y. 248 pages, illustrated. Price $2.50.

The Tennessee Valley Authority represents to many the most comprehensive regional transformation to which the U. S. government has been committed. Those who were alarmed at the threat to individual enterprise can learn here from the commissioner who is now chairman and who has been a member since the inception what the motivation was and what the achievements have been. The recital is a potent defense of a social metamorphosis which far transcended the capability or scope of any conceivable private-capital organization; in that sense the title of the book could justly have been "See Here, Private Capital" (your limitations by comparison with government). No more authentic portrayal can be conceived than this one about putting a river to work in harness and hobbles for the benefit of a decadent district, saving the productive soil, recreating industry, elevating the economic morale of the inhabitants—all a unified venture of what the author insists is decentralized democracy. Justification is offered for engagement in correlative measures, such as libraries, fertilizer programs, parks, mosquito regulation. In short, the pages record the social philosophy of those who are shaping the regional-uplift trend of an experimenting government.

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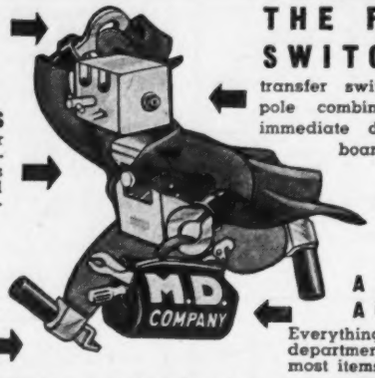

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DIESEL PLANT

Now Operating **Release May 30, 1944**

Busch-Sulzer 500 Hp—350 Kw
Fairbanks-Morse 300 Hp—200 Kw
Fairbanks-Morse 200 Hp—136 Kw
Fairbanks-Morse 100 Hp—72 Kw
Generation 2300 Volts 3 Phase 60 Cycle
Transmission 13000 Volts 3 Phase Wye

Descriptive bulletin on request

NEW MEXICO ELECTRIC SERVICE CO.
Box 239 **Dallas, Texas**

—TRANSFORMERS—

BOUGHT and SOLD

We have several thousand transformers in stock for prompt shipment, and invite your inquiries.

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We rewind, repair and redesign all makes and sizes.

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THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M **Since 1912** **CINCINNATI 27, OHIO**

VICK CHEMICAL COMPANY

War Plant Liquidation

Immediate delivery

New January 15th, 1943

D.C. Electrical Conversion and Distribution Equipment of General Electric Manufacture

ITEM	DESCRIPTION	CEILING PRICE
43	2—G.E. Thyrite By-Pass Arresters	$ 47.49
46	1—Incoming Panel Board, 1000 KV-A, 2300 v, 3 ph., 60 cy., panel 8′ 6″ high, 24″ mounting	
47	2—Watt Hour Meters	
48	1—FK143, 600-amp., 7,500 v, Manually Operated Oil Circuit Breaker, 50,000 KV-A interrupting capacity with 2 invert time overcurrent trips, 2 potential transformers, 3 disconnecting switches, necessary bus and connections	
49	1—Shunt Trip Coil—110 v, for use with FK143, 600 amp. manually operated oil circuit breaker	
50	1—Normally open Auxiliary Switch, for mounting on the oil circuit breaker	
51	1—Relay with one Normally Open Contact, 110 v, 60 cy., for use in connection with shunt trip coil	
	ITEMS 46–51	748.00
52	2—300 KW., 250 v DC, G.E. Ignitron Rectifiers, complete with 2300 v AC switch gear, type HTH, 353 KV-A, variable transformer, 6 EG-238-B Ignitron Tubes and DC Circuit Breakers and miscellaneous spare parts	26,625.60
53	1—G.E. Testing Rack for AC Switch Gear, CR2940 2K4 600 v maximum (No price available—cost included with other equipment, not listed.)	
54	4—Enclosed panels for wall mounting, each panel having 4 studs for 1200 amp., 250 v DC, each stud back connected with 2 lugs of 500,000 CM cable.	
55	2—DC Remote Panel Board for Operating DC Circuit Breaker of Rectifier, complete with volt and amp. meters	
56	1—Open panel for floor-mounting with 4 DPST knife switches, each 400 amps., 250 v DC	
57	4—DC Ammeters	
58	4—CR 1084 DC Overcurrent Relays	
59	1—6″ Alarm Bell	
	ITEMS 54–59	776.00
60	1—Sub-Base for Panel, complete with 4 ampere hour meters	268.80
61	1—Panel complete with 4 eleven point dial switches, 250 amps. and necessary grids	571.20

also Carrier Refrigeration System and Heating, Ventilating and Air-Washing Equipment

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1. Materials listed in this inventory are offered subject to prior sale.
2. Materials are sold on a where-is and as-is basis. Vick will render reasonable cooperation in having goods packed and shipped.
3. Ceiling prices listed herein are in accordance with interpretation obtained from legal counsel.
4. Vick retains the right to reject any offer which is deemed not acceptable.

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122 East 42nd Street, New York 17, New York

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in

New and used equipment recently released from service by a number of electric and gas utility companies.

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CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

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Power Equipment

Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries Transformers, Motors, Compressors, Induction Voltage Regulators, Oil Circuit Breakers, etc.

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COMPLETE POWER PLANT

now in operation at Blanche, Bell County, Kentucky, will be taken out of service within the next 30 to 60 days.

2—468 h.p. Stirling boilers equipped with automatic Firite Stokers, feed water pumps, blowers, soot blower and water heater.

1—G.E. 300 K.W. Curtis steam turbine 3600 rpm, 2300 volts, 60 cycle, 3 phase, with surface condenser and direct connected exciter.

1—G.E. 750 K.W. 1800 rpm, 2300 volts, 60 cycle, 3 phase jet condenser and 2 exciters, steam and electric.

Complete switch board and other auxiliaries.

We invite your inspection

BIG JIM COAL COMPANY
Blanche, Ky.

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that other readers can supply—
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Advertise it in the SEARCHLIGHT SECTION

SUCCESSFUL OPERATION GUARANTEED

Every Machine in This Ad is Owned Outright By Us

D C MOTORS

	HP	Make	Type	Volts	Speed
3—	1250	G.E.	MPC	550	130
1—	800	G.E.	MPC	660	600
2—	625	G.E.	MPC	500	130
1—	600	G.E.	MPC	600	650/900
1—	500	G.E.	MPC	230	900
1—	300	G.E.	DMC	230	400/600
1—	300	G.E.	MPC	230	275/550
2—	270	Whse.		550	250/400
1—	250	G.E.	C	230	375
1—	250	Al. Ch.		230	525
2—	200	Whse.		230	400
1—	175	Whse.	SK	250	150/525
1—	150	G.E.	RC-19A	230	800/1000
1—	150	G.E.	MPC	230	250/450
2—	130	Cr. Wh.	CMC-65H	550	1200
2—	125	G.E.	CO-1832	230	625
2—	120	Whse.	SK-180	230	720
1—	100	G.E.	LC-50	230	1200
1—	100	G.E.	MPC	230	225/450
1—	100	G.E.	RC-19	230	575/720
1—	75	G.E.	LC	230	500/1000
2—	75	Whse.	SK-183	230	550/1100
1—	60	El. Dy.	2SS	230	525/1050
2—	50/60	Cr. Wh.	65H	230	500/1000
1—	50	Cr. Wh.	CMC-81H	230	300/900
9—	50	G.E.	RF-16	230	400/1600

TRANSFORMERS

	KVA	Make	PH Type	Voltages
5—	1667	Pitts	1 OISC	13200x2300
1—	1050	G.E.	3 WCTH	11000x445
1—	600	G.E.	3 HT-OISC	11550x2200
1—	333	Moloney	1 C-OISC	22000/11000x2300/575
1—	333	Whse.	1 OISC	2300x460
1—	333	Pitts.	1 OISC	2400x2.0
1—	300	G.E.	1 H-RP	13200x575/1150/2300
1—	300	Pitts.	3 ODSC	4150x208/120
1—	300	Packard	1 OISC	2200x220/440
1—	200	G.E.	1 H-LDD	26400x115/460
1—	200	G.E.	1 H-OISC	2300x115/230

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1500 KW GE 275 V. Gen. d.c. to 2100 HP, 2300 V. Syn. Motor.
1—1500 KW Whse 250 v DC to 2100 HP 4400/2200 v.
1—1000 KW Whse. 600 V. Gen. d.c. to 1400 HP 4000 V. Syn.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
1—400 KW G. E. 250/275 V. Gen. to 700 HP ATI 440/2300/4000 V. Motor.
1—350 KW G. E. 220 v AC Gen. d.c. to 500 HP 350 v DC motor.
1—100 KW Whse. SK 250 V. Gen. to 150 HP Syn. 2300 V. 900 RPM motor with excit.
1—75 KW G. E. 125 V. Gen. to 120 HP IK 4000/2300 V. motor.

TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

ROTARY CONVERTERS

60 cycle

	KW	Make	Speed	D.C. Volt	Trans. Volts
1—	1500	Whse.	720	600	2300
1—	1500	Whse.	600	600	11500
1—	1250	G.E.	720	250	2300
1—	1000	G.E.	900	600	13200
1—	1000	Whse.	600	250	22000
1—	1000	Whse.	900	600	11000
1—	750	G.E.	1200	600	2300
1—	750	Whse.	720	250	6600/2300
1—	500	Whse.	1200	600	13200/2300
1—	375	G.E.	1200	250	6600/2300
2—	300	G.E.	1200	600	2300

25 cycle

2—	1500	G.E.	500	225/275	13200/6600
1—	500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and DC controls.

A. C. MOTORS

3 ph. 60 cycle
Synchronous

	HP	Make	Type	Volts	Speed
1—	500	G.E.	TS	440	360
1—	225	G.E.	ATI	240	600
1—	150	Al. Ch.		2300	900
1—	125	G.E.	ATI	220/440	900
1—	100	Whse.	G	2200	1800
1—	100	G.E.	ATI	220/440	720
1—	75	G.E.	TS-7556	220/440	600

Slip Ring

1—	1200	Cr-Wh.	801-Q	2200	257
1—	800	Whse.	CW	440	257
1—	800	Al. Ch.		440	585
2—	600	G.E.	IP	440/2200	720
1—	450	Whse.	CW	2200	575
1—	400	G.E.	IP	440/2200	600
1—	400	Al. Ch.		2300	505
1—	350	G.E.	IM	2300/4000	257
1—	300	Whse.	CW	440	585
1—	300	G.E.	IM	440	720
1—	250	G.E.	MT	4000/2300	257
2—	200	Whse.	CW	2200	514
1—	200	G.E.	IM	440	600

Squirrel Cage

4—	175/112	G.E.	IK-16	440 900/720
1—	500	G.E.	1-17B	2200 695
1—	400	Whse.	CS-1104A	2200 585
1—	350	G.E.	IK	440/2200 450
2—	300	G.E.	IK	440 350
1—	300	Whse.	CS	550 550
1—	300	G.E.	IK	2300 600
1—	125	Whse.	CS	220/550 1150
1—	125	G.E.	IK	220 720

SYNCHRONOUS CONDENSERS

1—	1000	G.E.	ATI	2200/3800	900
1—	750	G.E.	ATI	220/440	900
1—	600	G.E.	ATI	220/440	900

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What are your requirements? units up to 5000 kw available in stock.

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1000 KW, 460 volts, 3 phase, 25 cycle,
300 RPM, 1570 amperes, serial 4,900,000,
1250 KVA 0.8 p.f. 50-deg. rise General Electric, type ATI-10-1250M-300, with amortisseur winding, with 33 KW direct-connected exciter, with
1400 HP 460 volts, 3 phase, 60 cycle,
300 RPM General Electric, 1570 ampere
1250 KVA p.f. 0.9, 50-deg. type ATI-24-1250M-300 form C, with amortisseur winding.

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1314 W. Cermak Rd. Chicago, Ill.

J. L. HEMPHILL & CO. Inc.

ELECTRICAL ENGINEERS AND EQUIPMENT
1602 53rd Street, North Bergen, N. J.
N. Y. C. Tel.: LOngacre 5-3227—N. J. Tel.: UNion 3-2600

MOTOR—3 PHASE 60 CYCLE

1—500 HP, 900 RPM, 440 volt, Lincoln slip ring
1—400 HP, 514 RPM, 440 volt, Westg., slip ring
1—335 HP, 600 RPM, 2300 volt, G.E. syn.
1—500 HP, 900 RPM, 440 volt, Lincoln slip ring.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., sync.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v. G.E., sl. rg.
1—150 HP, 1800 RPM, 440 volts, G.E., sq. cg.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
2— 75 HP, 1200 RPM, 2300 volt, G.E., vertical

MOTORS—D. C. 230 VOLTS

2—450 HP, 400 RPM, General Electric MPL.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, 550 RPM, Westinghouse, SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, 625 RPM, G.E.
1— 80 HP, Crocker-Wheeler, 600 RPM.
1— 75 HP, 950 RPM, General Electric
1— 50 HP, RPM, Westinghouse, type SK.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v. Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—200 KVA, G.E., 2200-220/440 volts.
3—200 KVA, Allis-Chalmers, 2200/220/440
3—150 KVA, G.E., 33,000 2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts
3—100 KVA, G.E., 2200-220/110 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, Allis-Chalmers, 2200/220/110
3—100 KVA, Allis-Chalmers, 2400/4150Y-2400
3— 75 KVA, General Electric 2200/220/440.

MOTORS GENERATOR SETS

1—750 KW, 250 volt, Allis-Chalmers, synchronous.
1— 75 KW, 125 volt, General Electric, squirrel cage.
1— 6 KW, 125 volt, General Electric, squirrel cage.

MOTORS—VARIABLE SPEED 230 VOLTS

1—100 HP, 475/1425 RPM, Electro Dynamic
1— 90 HP, 470/940 RPM, General Electric.
1— 75 HP, 525/1575 RPM, Electric Dynamic.
1— 35 HP, 500/1500 RPM, Westinghouse.
1— 35 HP, 350/1050 RPM, Electric Dynamic.
1— 30 HP, 225/900 RPM, Crocker-Wheeler.
2— 25 HP, 300/900 RPM, Electro Dynamic.
1— 20 HP, 750/1500 RPM, General Electric.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker-Wheeler.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—225 KVA, 514 RPM, 600 volt, Westinghouse.
1—200 KVA, 3600 RPM, 240 volt, Allis-Chalmers.
1—62½ KVA, 3600 RPM, 220 volt, Allis-Chalmers.

TURBO-GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

ENGINE GENERATOR SETS

1—150 KVA, General Electric Generator, Ames Uniflow engine.
1—62½ KVA, Westinghouse Generator. Fairbanks company engine.

Complete Line of A.C. and D.C. Motors and Generators

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The Searchlight Section is at your service for bringing business needs or "opportunities" to the attention of men associated in executive management, sales and responsible technical, engineering and operating capacities with the industry served by this publication.

WANTED

1—AC Single-Phase Belt-driven Generator with Base and Exiter 25 or 30 KVA, 125 volts, 60 cycles 900 or 1200 R.P.M. with complete control-panel

HALE COMPANY
East Arlington, Vermont

For Sale

1—G.E. 500 KW non-condensing turbo generator located at Geneva, N. Y.
If interested, write
New York State Electric & Gas Corp.
Binghamton, N. Y., attention
L. A. Trinkino for complete details.

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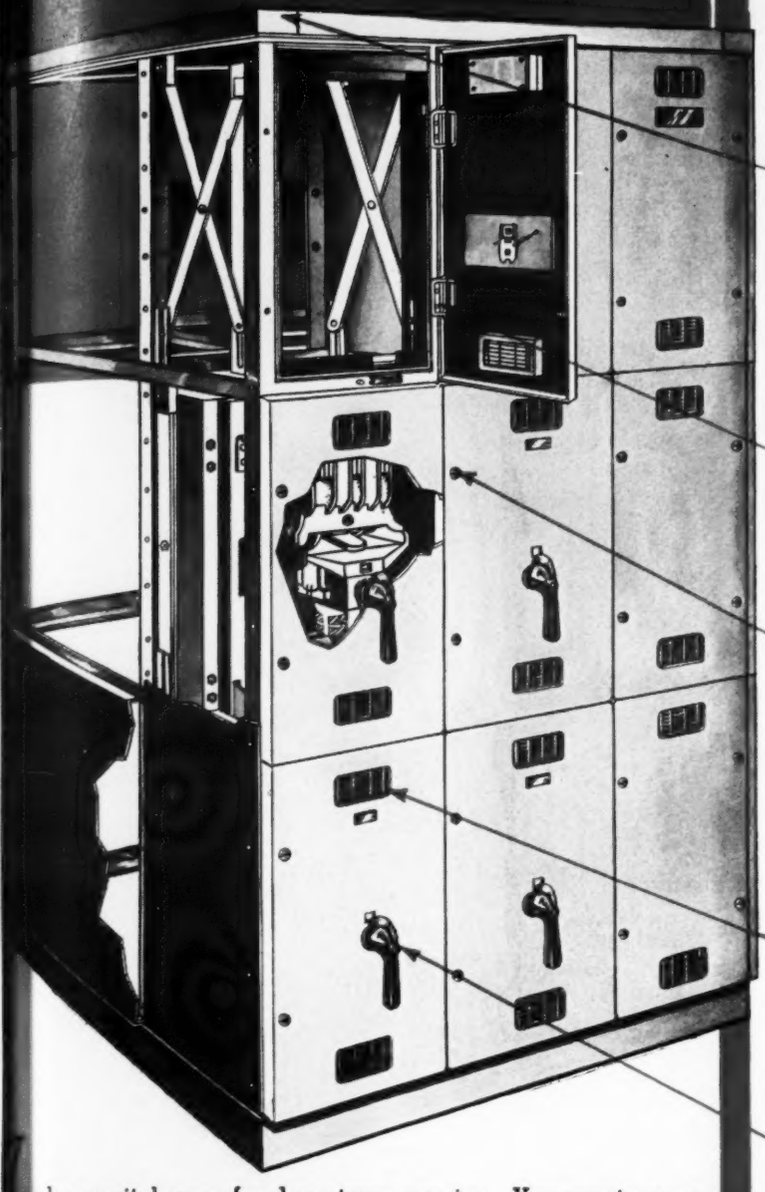
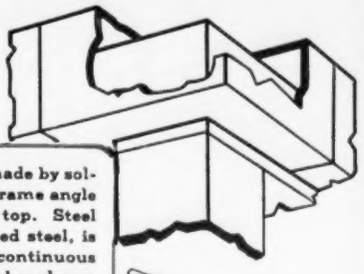
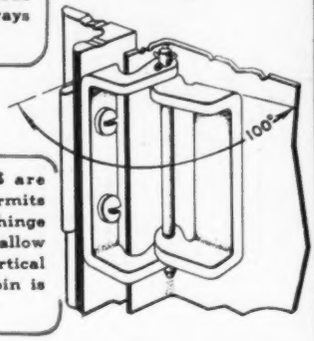
★ **These companies have supplied additional buying information on their products in the 1944 edition of the Electrical Buyers' Reference**

DETAILS TOO—YOUR NEEDS GUIDE DESIGN OF I-T-E DRAWOUT SWITCHGEAR

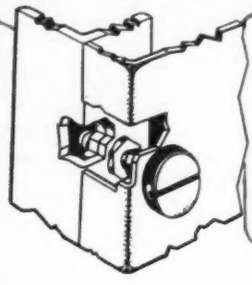




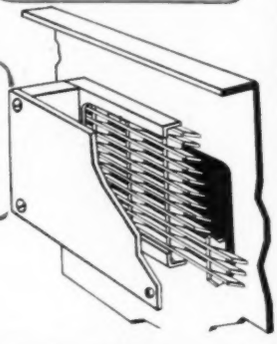
CORNERS are made by solidly welding frame angle to sheet-steel top. Steel trim, of formed steel, is added as a continuous finishing member always in alignment.



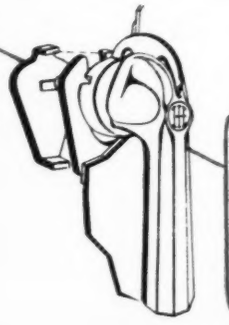
CONCEALED HINGES are sturdy. Design permits 100° swing. Slots in hinge and frame-angle allow horizontal and vertical alignment. Hingepin is readily removable.



PANEL SCREW has large head chamfered to prevent marring of finish. Palnut keeps screw attached to door at all times. Floating nut-block permits adjustment so that screw can be perfectly aligned with fastening thread.



LOUVERS are grille type, giving adequate air flow. Mounting is flush. Baffling is used when ventilating opening is close to arc chutes.



OPERATING HANDLE, mounted on front of door, disengages automatically when door is opened. Only 90° turn is required to close or trip the circuit breaker. Handle may be padlocked in open position.

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